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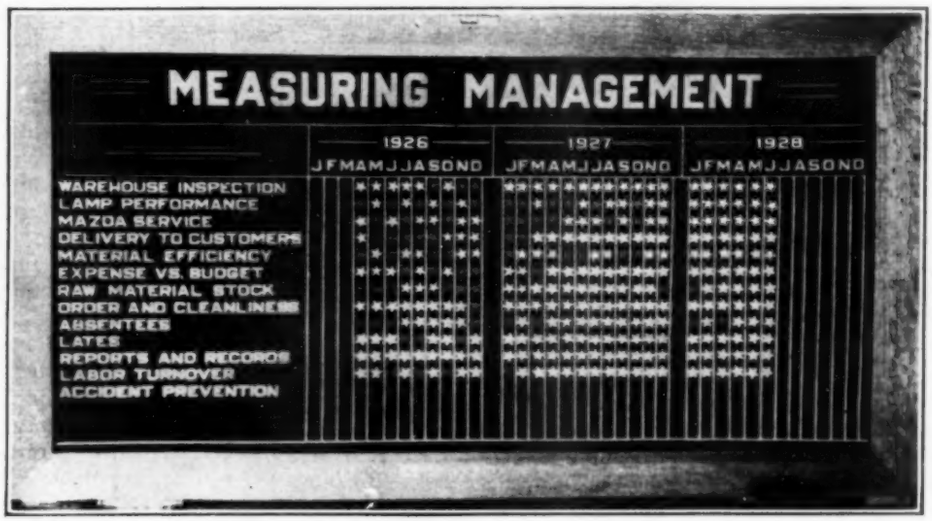

A Plan *for Measuring Management*

By Frank J. Oliver, Jr.
Editorial Staff, American Machinist

Four major factors are considered—Plan is to set bogies against which actual results are compared to determine performance efficiency

ALTHOUGH the plan for measuring management about to be described was developed for use by the Westinghouse Lamp Company, for the purpose of comparing the ratings of six widely scattered factories, the principles involved are applicable to any manufacturing enterprise whether the quantity of goods produced be large or small. There does not even have to be a comparison between two or more plants, although obviously this is an important object of the system; a single plant "management" can be scored against some carefully devised standard or bogey. Necessarily, in order to illustrate the application of the idea in this particular company, problems peculiar to lamp making will come up, but the reader need only substitute his own quality standards, for example, to make the transposition to his particular problem of measuring management.

Management at the Westinghouse Lamp Company factories is measured on four counts: quality, service to customer, cost, and personnel control, in the order of their importance. The weight of the four basic factors is graded according to the particular conditions as follows:

Quality	30
Service to Customer	25
Cost	25
Personnel control	20
Total Score	100

In connection with the plan, a bonus is provided to supply the necessary incentive to management. What actually happens is that the superintendent (who does not participate) of each plant receives in a lump sum the bonus for his staff from assistant superintendent down to the foremen and divides it proportionally to their salaries and the results obtained by them. To obtain the right psychological effect, the distribution of the bonus takes place semi-publically, and penalties are de-

ducted openly. For example, the chief may say, "John, your share of the bonus is $50, but I am only going to give you $40, because you failed to carry out my orders in regard to installing a safety device on Machine No. 103."

Before any definite ratings can be given on each of the four counts, they must be further subdivided into fourteen parts as follows:

(*A*) Quality
1. Warehouse inspection
2. Lamp performance
3. Initial quality inspection

(*B*) Service—Delivery to customers

(*C*) Cost
1. Material efficiency
2. Labor efficiency
3. Expense vs. budget

(*D*) Personnel Control
1. Raw material stock
2. Order and cleanliness
3. Absentees
4. Latenesses
5. Reports and records
6. Labor turnover
7. Accident prevention

Each of these subdivisions will be explained in turn and the method of measuring developed. Management, considered as a whole, appears to be so intangible a quantity as to be unmeasurable, but by using the scientific method—breaking the problem down into measurable subdivisions—a trustworthy result can be obtained.

Warehouse inspection ranks first because it insures the quality of the product that the customer will receive. Lamp performance and initial quality inspection count equal weight, one third, however.

Warehouse inspection covers a percentage of the finished product and takes into account all major deficiencies. A perfect score is 1,000 points and deductions are made from this for defects. Demerits vary depending upon the seriousness of defect. An obvious dud—a lamp that fails as soon as placed in socket—is a serious defect as it indicates loss of vacuum, broken filament, etc. The presence of ½ per cent duds results in subtraction of 75-100 points from the score. Appearance defects, on the other hand, which are not detrimental to performance, carry lower demerits. The presence of ½ per cent of these defects, for example, rate 10-20 demerits, depending again upon nature of the defect in this minor defect class.

Lamp performance is based on life test results and takes into account the average hours of life at a stated efficiency. Equal weight is given to life and efficiency. Life ratings are scored not only on the average, but also on dispersion from the bogey, above and below it. As time goes on this life band is being narrowed, testifying to the improvement in quality being obtained as more information becomes available. Similarly, efficiency, stated in lumens, or light units per watt of power consumed, is held within close limits. A batch of lamps that scores high in life might do so because of low efficiency and would be marked down accordingly.

Initial quality inspection is measured in the following manner: A percentage of the product, packed in cartons, ready to be sealed, after the final factory inspection is inspected by an outside, disinterested agency. The test comprises a full check of quality. The results of this inspection are a measure of the ability of the factory to deliver a product to the warehouse without reconditioning. In other words it represents manufactured quality at the source, as against warehouse inspection which represents quality delivered. Thus, it is possible for a division to have a high rating on warehouse inspection while scoring a low rating on this initial inspection by the outside agency.

General Discussion on Quality

At this point it might be well to discuss quality in general. In the first place quality must be maintained at the source—the raw materials used in the manufacture of the product. All material is bought on specification and is inspected or tested according to standard procedure. The specifications and inspection instructions are set or prepared by a Standard Material Committee composed of representatives of both the factory and the engineering department. The general engineering department, acting as consultants, in turn, issue all specifications on the finished product and on the processes used to obtain the results specified. In each division or plant (some of the large plants may have several divisions) there is a quality engineer who follows material and product inspections and processes and is responsible to the plant superintendent. It is up to the quality engineer to say whether or not a machine shall be stopped and repaired if defects appear in the product. The superintendent is responsible for all operation in his plant, however, and he also may order a machine to be withdrawn from activity and repaired.

The part the operator plays in determining quality of the product is secondary to that played by the machine maintenance man, since in lamp or vacuum tube manufacture most of the operations are performed on semi-automatic machines, and the chief functions of the operators are loading and watching the machines. In some cases there are simple sub-assemblies performed by hand also, such as inserting wire in glass tubes, lead wires in bases and the like, but the maintenance of a proper vacuum, the heating, fusing and shaping of the glass is all subject to the condition and adjustment of the machine. Hence the maintenance men are also paid a bonus on the basis of quality measured by the inspection report on each unit. Payment is on the basis of dollars for a definite score. For example, if 95 per cent of the product passes, the maintenance man receives $5 at the end of the month; 96 per cent, $10; 97 per cent, $20; and so on.

In addition to the monetary reward, incentive to improve quality is created by psychological factors such as attention-getting boards and charts. These forms are changed frequently as they quickly lose their appeal. In one instance, a board was displayed with a column of maintenance men's names at the left and opposite each name, spaces and colored lights. A red light indicated a serious defect, while a green one indicated a lesser one. In the space beside the lamp was chalked a note as to the number and location of the defect. Naturally a man didn't like to see a red light beside his name for very long.

As the product leaves the machines it is checked by a girl inspector. Her base rate of pay is slightly lower than the machine operators, but she is given a bonus for efficiency so that her pay actually is slightly higher. The bonus takes into account that she is not passing inferior quality in order to show a high production. Similarly a high number of rejections, where not justified, counts against her.

Standards of quality are being constantly improved.

Each month a quality meeting is held with this end in view. The superintendent and quality engineer of each division sits in with representatives of the general engineering department and of the general superintendent's office. General quality conditions are discussed, and in the case of a general chronic complaint, means are adopted to correct the condition. Where the complaint originates with the customer, a member of the commercial engineering department investigates the case and presents his findings to the quality committee for action and remedy.

As stated before, the three points of quality, warehouse inspection, lamp performance and initial inspection, are scored equally in the bonus plan for measuring management. An arithmetical mean or average is taken for all three counts and is converted into a score number according to the following scale:

Points (on basis of 1,000)	Score Per cent
990 and over	100
985-989	90
980-984	80
975-979	70
970-974	60
965-969	50
960-964	40
955-959	30
950-954	20
Under 950	0

For example, if the three quality points are warehouse inspection, 970, performance, 980, and initial inspection 960, the average is 970 and the score is 60. Since the weight for quality, as mentioned in the early part of the article, is 30, the final rating is 60 per cent of 30, or 18 points.

It is interesting to note in this connection that two years ago 950 points scored 100, and 900 zero. The raise in bogey that has taken place is a graphic illustration of the increase in quality obtained.

Almost as much importance as is attached to quality is given to service to customers measured by promptness in delivery and in filling orders. A different scale of measurement had to be applied here, of course. A typical method of scoring is indicated below. While the figures are not exact, they illustrate perfectly the system on which they are based.

Time from receipt of order to delivery at factory door	Merits or Demerits	Example: No. of orders	Example: Score
	Stock Types		
0-2 days	+ 1	1,000	+1,000
3-5 "	— 1	100	— 100
5-10 "	— 5	10	— 50
10-15 "	—10	0	0
			850 net
	Non-Stock		
0-10 days	+ 1	100	+100
10-15 "	— 1	40	— 40
15-20 "	— 5	2	— 10
			50 net
	Totals	1,252	900

$$\text{Efficiency} = \frac{900}{1{,}252} \times 100 = 72 \text{ per cent}$$

The example given is a poor one since most of the plants attain an efficiency of 98 per cent and above. In figuring this score the elapsed time is the total time in days from the receipt of order to the delivery of goods from the factory door. This figure, therefore, is a measure of not only warehouse efficiency but also, and chiefly, planning efficiency. This holds true for regular stock types as well as non-stock types that have to be made to order. It also signifies that the plant is prepared to handle special orders on short notice.

As a further indication of the high bogey set, the following scoring scale is used for the rating of service to customers.

Efficiency Per cent	Score Per cent
100	100
99	90
98	80
97	70
96	60
95	50
Under 95	0

In other words, unless a plant stays above 95 per cent in service-to-customer efficiency, no bonus is paid for this particular performance.

Cost of manufacture is the third group count by which management is measured. As in the first count, this rating is broken down into three divisions, in this case, the three items that go to make up cost: material, labor and overhead.

Material efficiency is the opposite of material waste. It represents the conservation of material. As a daily check on this waste in the plant, the word "shrinkage" has been applied; that is, if an operator is given materials for 100 lamps and she makes 98, parts of two being broken, the shrinkage is 2 per cent. Material efficiency is a more inclusive term and takes into account the cumulative material losses in *all* operations. The system presupposes a complete knowledge of the cost of material for every individual product. The theoretical expenditure for material is equal to the number of complete products delivered to the shipping room multiplied by the standard material cost per unit. This figure is then compared with the actual material cost obtained from the figures of actual consumption after inventory. Suppose, for example, 100 parts were completed at a standard material cost of 10 cents each. The theoretical material cost would be $10. If, however, inventory indicated that $10.30 worth of material had been withdrawn from stock to complete the order, the efficiency would be

$$\frac{10.00}{10.30} \times 100, \text{ or } 97 \text{ per cent.}$$

Here again it will be seen that the bogey for bonus payment is not easy of accomplishment.

Per cent Material Efficiency	Score
100	100
99	90
98	80
97	70
96	50
95	25
Under 95	0

The second factor in measuring cost is labor, and in calculating it a theoretical labor standard is first set for each machine or operation. For machine work, par is calculated on the speed of the indexing table, or other fundamental operation control. It should be noted that

the principle of operation of most lamp making machines is similar and in almost every case, the work is loaded by hand on a rotating table by means of which it is carried to the various work stations. The operator can load and insert parts no faster than loading positions are presented to her, so that this speed is taken as the basic figure. Naturally it is never attained by the operator, due to rest periods and other causes. Where hand work alone is involved, a time study is made of the best known performance—not the best average—and this is set as the bogey. With this basis of measurement, 70 per cent labor efficiency is considered good is some cases, and the top mark is around 75 per cent.

The labor efficiency figure is also a measure of machine efficiency in a secondary way, since a low labor efficiency on the machine may indicate that it is not being used to best advantage.

Overhead, the third item of cost, is expressed in terms of the ratio of actual expense to budgeted expense, giving a dual check, one upon expense, another upon the budget. Two budgeting periods are used, from April to September, and from October through March. It is obvious that factory light and heat are the chief overhead items subject to severe seasonal fluctuations and for this reason the budget periods are divided as mentioned. It should be understood that the budget figure is not static. On the other hand, it is being constantly pared down by constant attention to details, and as this paring takes place, actual factory expense must follow if a score is to be made on this item. A comparison of the score points against the budgets ratio shows how closely the two factors must jibe.

Expense Ratio to Budget Per cent	Score or Weight
100	100
99	90
98	80
97	70
Under 96	0

In making this rating the arithmetic average of the current figure for the month and those of the two preceding months is compared, each month, against the bogey average. The three units of cost, material, labor and overhead, are weighted according to total cost.

In the fourth division, personnel control is measured, being broken down into seven subdivisions. The first is not actually related to personnel, but is merely grouped with the other six factors for convenience. It represents raw material stock efficiency and is measured in terms of turnover of stock each month and in the reduction of inventory on slow-moving stock. Of the other six factors, order and cleanliness, absentees, "lates," reports and records, labor turnover, and accident prevention, the first is the least tangible, that is, subject to the least accuracy in measurement. The plant motto on this score is "A place for everything and everything in place." Floors, walls, ceilings, corners, windows, fixtures and machinery are regularly inspected by a committee and scored very good (5), good (4), fair (3), poor (2), or very poor (1). Each unit is scored and the total compared with the maximum possible. Thus, if ten units in a section are scored, 50 points become the bogey, and a rating of 40 points, for example would be called 80 per cent efficiency.

In order to carry out this policy effectively it was necessary to obtain the co-operation of the entire organization in each plant. When the plan was first put in operation, each employee was instructed as to the standard of cleanliness expected and then the plant management was told to score it. Frequent checks were then made to keep the standards high. Stated in words, the message was "The less dirt made, the fewer janitors," and "Fewer Janitors—Less Expense." As a result, one can enter the machine shop, where most of the company's own equipment is built, and find the place spick and span—no accumulated junk can be found under the machines, no chips scattered over the floor, no wilderness of mixed up tools on the benches—everything is neat and orderly. Does it pay to be finiky? Yes, the better environment raises the morale of workers, lowers accidents and increases mechanical efficiency, the management claims.

Absentees affect overhead through idle equipment, and therefore an effort is made to keep this source of loss within reasonable bounds by making it a scoring point. Bogey is 2 per cent lost hours due to absentees against the total possible employee-hours for each month. Employees when absent over two weeks are placed on inactive payroll and not scored as absent. A visiting nurse checks up on sick cases.

How Lateness Is Measured

Lateness is also given close attention. For this factor, the bogey is 0.1 per cent of operator-chances per month. For example, in the Bloomfield plant, 3,000 employees have two chances a day of being late, morning and afternoon, or $3{,}000 \times 2 \times 25 = 150{,}000$ chances during a month of 25 working days. Bogey would be 150 "lates" during the month.

It is felt that discipline in regard to lateness benefits not only the plant, but also the individual. Lateness interferes with the operation of machines requiring a group of operators. A late employee arrives in a rush and is therefore subnormal, and hence more susceptible to accident and poor work.

As an additional precaution, two degrees of lateness are used: official and unofficial. The work day starts at 7:45 a.m., but each operator is expected to be at her place at 7:40 a.m. Arrival between 7:40 and 7:45 is an unofficial "late," after that period an official "late," for which deductions are made on the score for this phase of management. Official lates are taken into account when an increase in rate or other promotion is being considered, while unofficial lates act more as warnings both to the individual and to the management.

In the machine shop, no docking is made for latenesses, but the offender is expected to report to a special committee of co-workers. If he has a legitimate excuse, no penalty is incurred, although it does affect the division's score. Constant offenders are discharged, of course.

Reports and records kept by foremen and higher managerial men must be on time and correct, and in scoring this factor one point is deducted for each day late and for each error.

Another item of the personnel group is labor turnover. Bogey is 4 per cent per month and the actual figure is calculated as the percentage of "dismissals" and "quits" to the total number on the payroll at the end of the month. Accident prevention is scored on the ratio of the total number of lost hours per month to the total possible employee-hours. No definite bogey has yet been set as past records are still being scanned with the purpose of establishing a reasonable figure. It is planned, however, to make every accident count, no matter how

minor it may be. Even 10 min. lost in obtaining a simple dressing for a slight cut will be scored in the total, since most accidents in this type of plant are minor, but represent a sizeable amount of lost hours in the aggregate.

The seven factors of personnel control, all expressed in per cent of bogey are averaged and scored according to the following rating:

Per cent of bogey	Score	Example	
100	100		
99	95	Raw material	93
98	90	Order and cleanliness	75
97	85	Absentees	98
96	80	Lates	80
95	75	Reports	95
94	70	Labor turnover	75
93	65	Accident Prevention	86
92	60		
91	55	Avg.	86
90	50	Rating	30
89	45		
88	40		
87	35		
86	30		
85	25		
84	20		
83	15		
82	10		
81	5		

For lamp manufacture, the total count for the personnel control is 20 so that in the example given the score for this division would be 6 points.

All performance ratings in this measuring-management scheme are made up by each division head and are submitted to the general superintendent's office. In this way, if a poor product is being made, for example, the man responsible for production is obliged to score himself low. The phsychological effect is such that he will make an extra effort the next month to see that he is able to score his department high. There is no tendency to falsify reports as an error in a report like this one, counts against the department score.

Summary

With this system of measurement, management is enabled to keep its finger on the pulse of the factory and pull up the loose ends. The old adage "Knowledge is power" may be well adopted by plant executives and a scheme such as the one just described provides automatically the necessary knowledge. After two years' use in the Westinghouse Lamp Company factories, the plan resulted in a marked increase in efficiency and a general raising of the morale of the entire personnel. Even more noteworthy is the fact that all the data used in the measuring plan are obtained from the regular factory records, the only additional work necessary being the compilation of these facts to deduce the scores.

In order to provide an additional incentive, besides the monetary one offered management, a score board, illustrated in the headpiece of this article, has been installed in each factory. It shows at a glance just what progress has been made since the measuring plan was started 2½ years ago. Each month a score is placed besides each of the points of measurement. A red star indicates a poor score, a blue one, fair, and a white one good. The object is, of course, to obtain a pure white field—a task of no easy accomplishment, considering the high bogies set.

Tom Johnson Proposes Starting a Bank

By John R. Godfrey

YOUNG Tom Johnson has broken out with a new idea that sort of jarred the old man off his pins, so to speak.

"It's bad enough, Godfrey, when Tom springs a new notion about machines or methods. But what do you think he wants to do now, John R.?—start a bank, by gosh! Crazy idea."

"What's it all about, Tom?"

"Dad is a bit excited, Uncle John. Let me tell you the story.

"We, and that includes Dad, have talked a lot about helping the worker to save money. We've preached thrift, and home-buying and all the rest, but we haven't helped to make it as easy for them as we might."

"Hold on," broke in the old man, "we've helped them with building and loan associations and we've loaned them money to keep them away from the loan sharks."

"Sure we have, Dad. We've done a lot more than most of the business men in town. But there's still another thing to be done. The banks ought to do it, but if they won't, I think it's up to the big business men of the town."

"Well, spill it, Tom—don't keep Godfrey waiting while you chew over preliminaries."

"It's like this: We all know the convenience of paying bills by check. We know it's dangerous to carry much cash in our jeans, both on account of hold-up men and because it's very apt to burn a hole in our pockets. We don't spend nearly as much when we tuck it away in the bank."

"Every bank has a savings deposit, Tom."

"Yes, Dad, but you know what a nuisance it is to draw money out of a savings bank to pay bills. But when you write a check and mail it and you don't care much whether you get a receipt or not as long as the cancelled check comes back.

"Banks don't like to bother with small accounts and I can see why. But it's mighty discouraging to the workman to have no such convenient way of handling money as we do."

"No law against their starting a checking account is there?"

"Amounts to almost a law. Mighty few banks will take a checking account unless you keep a balance of two hundred dollars as a minimum. Some want five hundred. No objection to that if you have it, of course, but how many of the average run of shop men have even two hundred dollars that they can soak away just for the chance to have a checking account? And drawing no interest at that.

"It seems to me that the business men of the town might get some plan to working so that the cost of handling these small accounts could be pooled, and the minimum amount dropped to fifty dollars. I'd rather not go into the banking business, Dad; we have troubles enough now. But I'm inclined to believe it might pay, in good will and general thrift of our men, if the banks can't, or won't.

"Why don't you spring it on your Chamber of Commerce, or your Rotary Club—and show them it's the thing to do?" piped up John. R.

"May not be such a bad notion after all, John R., I'll think it over. But I hope Tom won't get too many new ideas."

Conveyors for Small Motor Parts

Photographs and data by courtesy of the Westinghouse Electric and Manufacturing Company, Springfield Works

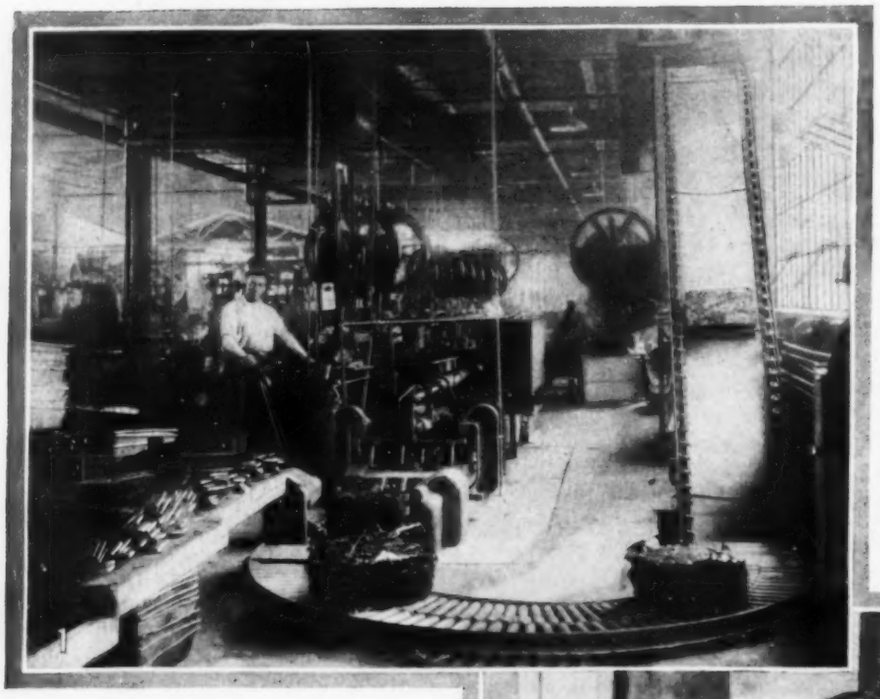

Fig. 1—The scrap-baling machine ejects the bales upon the rollers of the gravity conveyor by which they are carried around the half-circle and deposited upon the power-driven inclined conveyor, to be delivered into a waiting freight car outside the factory wall

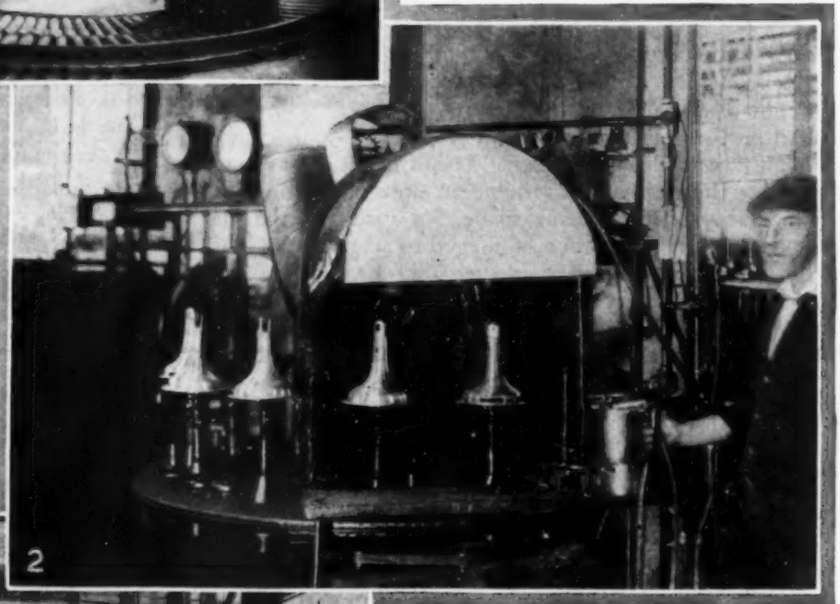

Fig. 2—Fan bases are enameled by the spray process. On the face of the slowly and continuously revolving table of the machine are a number of vertical spindles, which revolve only when a small drum on the lower end comes into contact with a moving belt below the main table. Thus the bases immediately before the operator are spinning rapidly as they pass his position. Another operator, behind the machine, takes off the enameled parts, replaces them with others to be enameled, and hangs the enameled ones upon a vertical conveyor which passes through the drying ovens

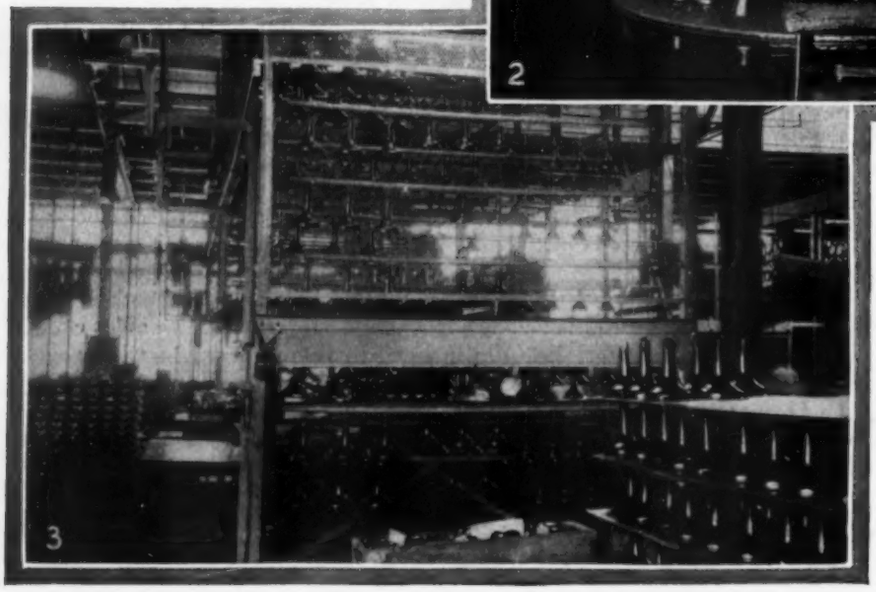

Fig. 3 — After the enameled bases have dried they are suspended from the bars of the conveyor, by which they are elevated. They cross the room upon the horizontal section of the conveyor to be seen in Fig. 4

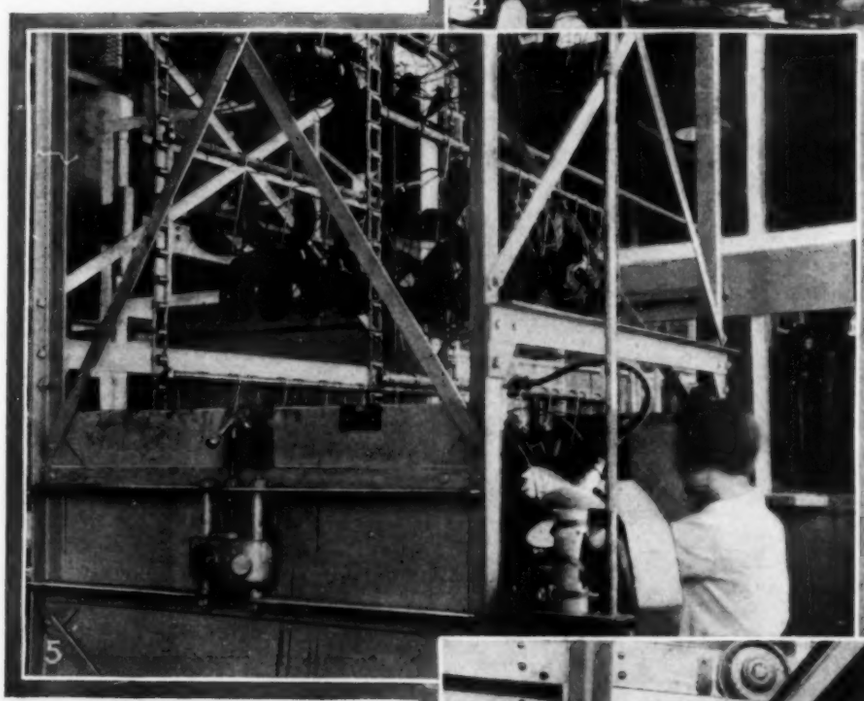

Fig. 4—In making the transverse passage, the parts descend at intervals to the level of the several assembling benches, where they meet for assembly with other parts. Fig. 5 shows the opposite end of a similar conveyor upon which fan blades and guards are handled in the same way

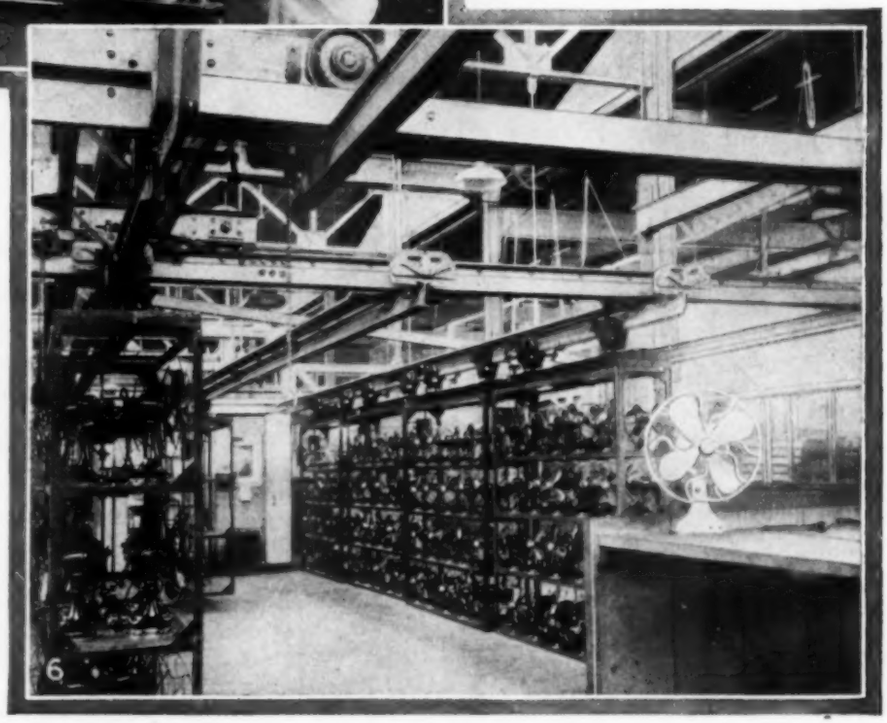

Fig. 6—Completely assembled fans are placed upon the shelves of suspended racks, each of which is wired and is provided with a number of sockets corresponding to the number of fans upon the racks. The attachment cord of every fan is plugged into a receptacle, and when the rack is moved to the "live" section of the overhead rail the fans are automatically set in motion under their own power. The running test continues for several hours under the eyes of the inspectors

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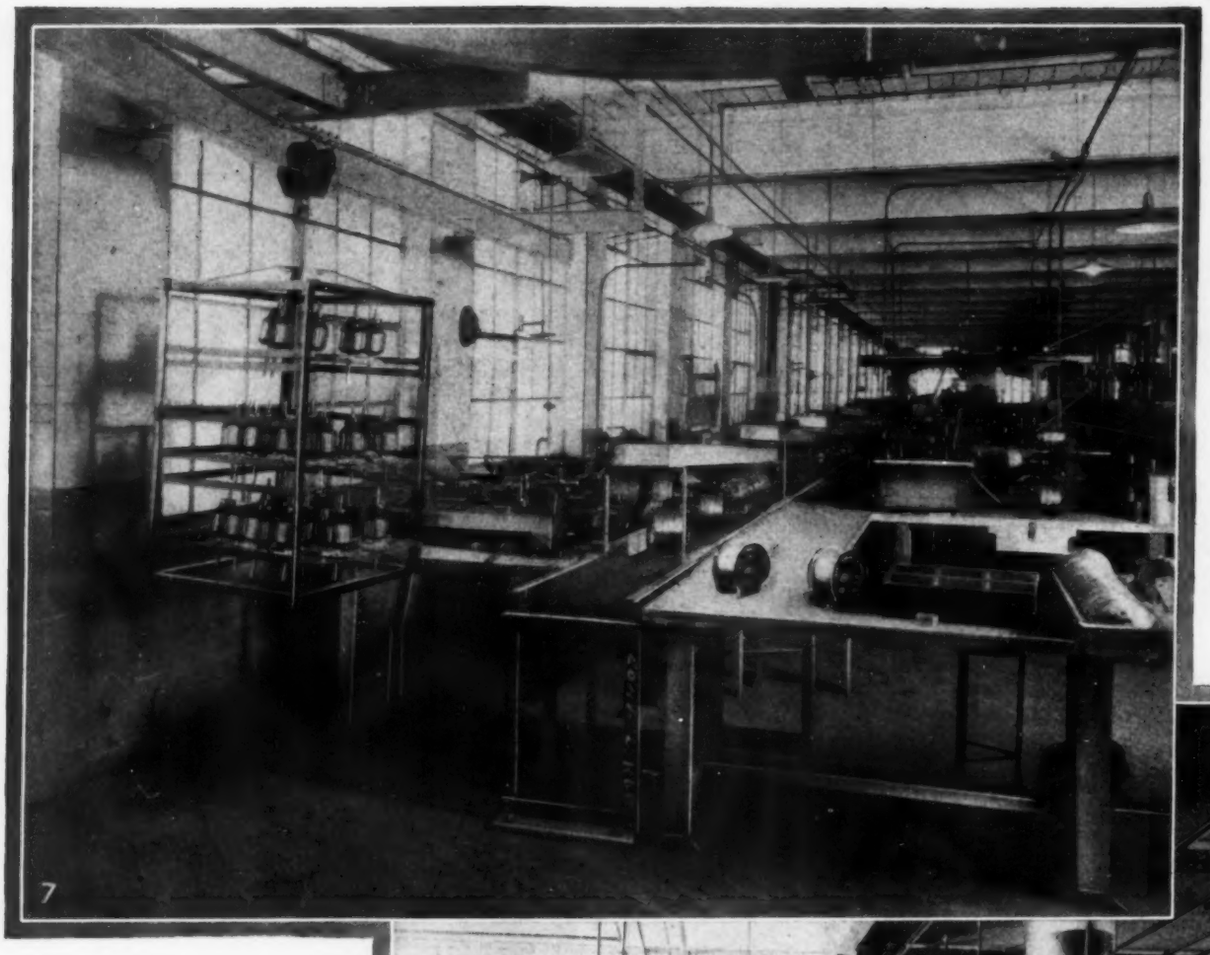


Fig. 7—Two types of conveyors in the department where motors for washing machines are made. The suspended rack at the left handles the assembled rotors and the belt near the middle of the room carries forward the parts of the stator to their several assembly positions

Fig. 8—The gravity conveyors carry the end-shields through the various machining operations necessary to fit them for assembling. In Fig. 9 may be seen the opposite end of the same conveyor system. For the greater part of its length this conveyor is horizontal. As each operator completes his portion of the work upon a tray of parts, the tray is pushed along the conveyor by hand to the next position

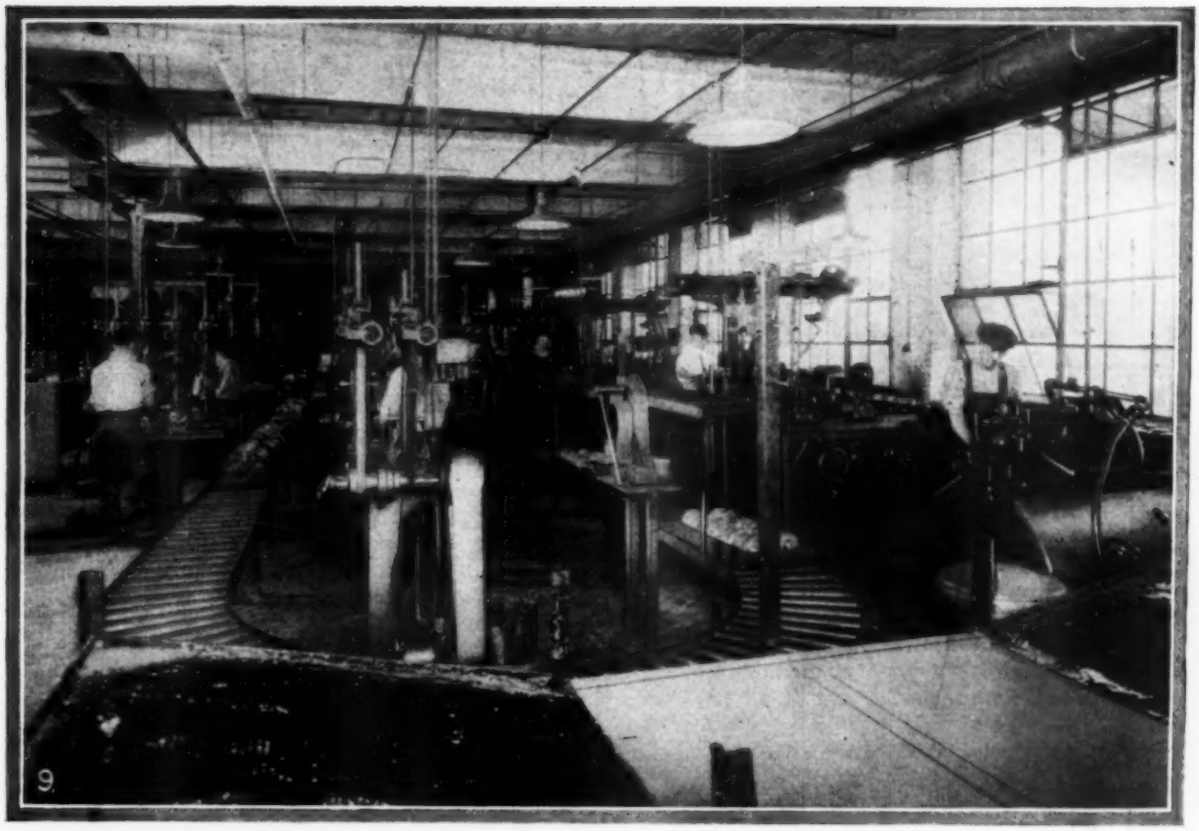
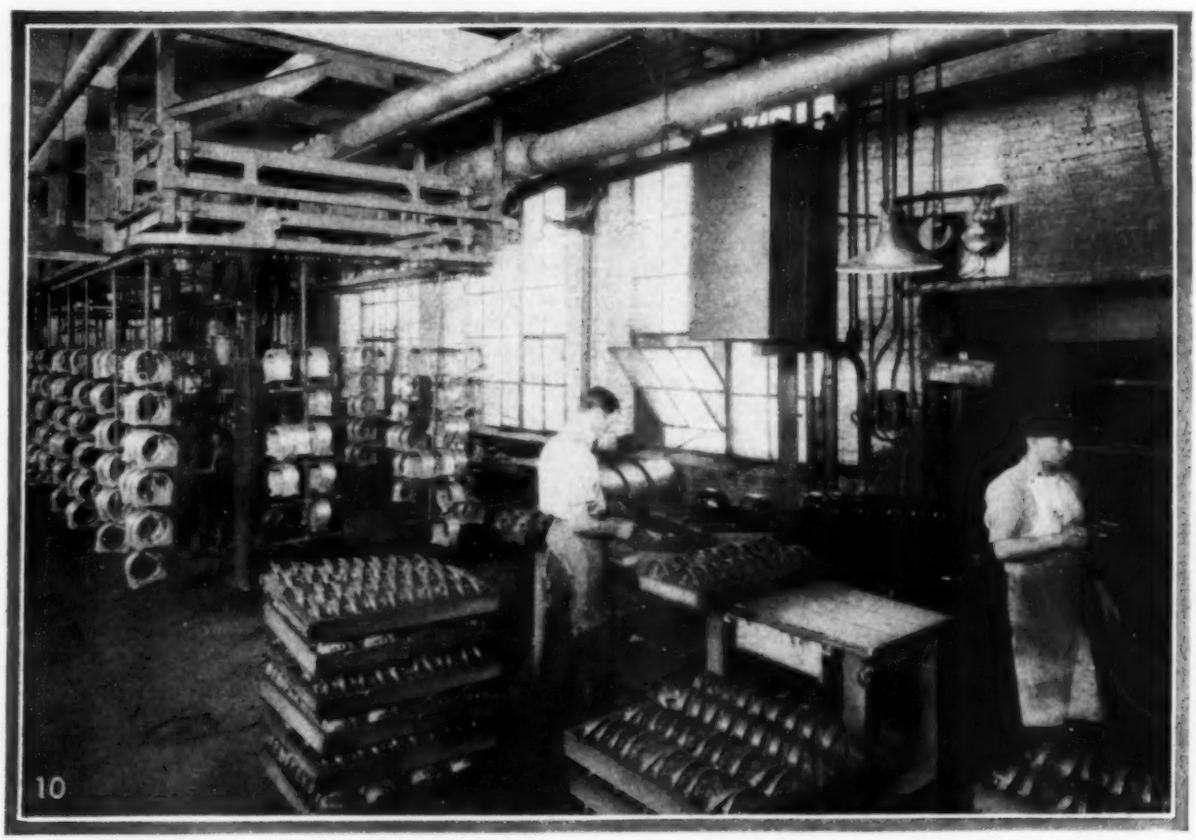


Fig. 10—Another type of suspended conveyor handles the stator frames. This conveyor moves continuously by power, and each operator removes the parts upon which his operation is to be done as they pass his machine, returning them to the same conveyor when he has finished them. At the right may be seen the lower end of the vertical conveyor upon which the enameled frames are carried through drying ovens as the final finishing operation



The Man Over Fifty

THE Milltown Chamber of Commerce was discussing the problem of employment. "What worries me to some extent," said President White, "is the problem of the old men in the shop. We want to play fair with our men. Many of them have worked for us for twenty years or more. They've been loyal to us and we don't want all the loyalty to be on one side. But in these days of high pressure production few men over fifty-five can stand the pace of the production line. It's too much for them and it delays the production line. The younger men don't like it as it interferes with their earnings."

"We give them the choice of being watchmen or sweepers," said a Mr. Plank. "If they need a job they're glad to take it and earn a living."

"One large concern I know," replied Holland, "takes men out of the production line when it comes to the point you mention. They put them on other work that utilizes the skill they have acquired in years and keeps them happier than when they constantly have the feeling they are not quite keeping up with the procession.

"Mr. Plank's plan of making watchmen and sweepers of them doesn't appeal to me at all. It's humiliating to the men, it's hardly a fair recognition of past services, and you lose a lot of skill and knowledge they have accumulated."

"Just how do they use them, Mr. Holland? I'd like to do that but I don't quite see how it would fit into the work."

"The plan may not work in all cases, Mr. White. This plant has a certain amount of repair work on its old apparatus where the old men's knowledge is of real value. Men of this kind can frequently be useful in overhauling machine equipment, unless it's a breakdown rush job. Even here, a little knowledge, born of experience, is often of more value than a lot of misdirected energy. I believe that you can find work for those who ought to stay if you study the problem a bit more. There's nothing more discouraging to a man, of say 45, than to see men a few years older dropped for one pretense or another. It breeds a feeling of insecurity, and the loyalty we all like to think about gets an awful jolt."

"Any man ought to have saved enough by the time he's 55 or 60 to live without a job," spoke up Mr. Plank.

"That isn't any answer," said Mr. Holland. "Admitting that he should, we know that few do. Sickness, accidents, being out of work, frequently through no fault of theirs, all tend to prevent it. Many are very improvident, as we know. But according to our present standards we can't let them starve. It's a case of giving some kind of a job or supporting them by public charity. And modern business men are not advocating that."

"What about pensions, Mr. Holland?" asked another member of the conference.

"Many firms pension old employees, usually basing the amount on the years of service. Sometimes particularly valuable service gets a higher rate. Some feel that it is better to pension them than to have them delay production in the shop. On the other hand the men are usually happier with something to do, and many try to find even part-time work for them. One firm I know occasionally retains an old foreman or super as a consultant, and has him report once or twice a month to go over questions that come up. It makes him feel that he is of service—and he frequently is."

"Well, we've all got something to think about, anyhow," said President White, as the conference broke up.

Executives are invited to discuss the problem involved in the foregoing case. They are also urged to use this department to air their own problems. A letter to the Executive Forum Editor is all that is needed.

Discussion

How Much Overhead?

The question as to what goes into the make-up of overhead, is answered in almost as many ways as there are plants applying it to their costs, all depending on what sort of showing these plants wish to make in their financial statements.

EXECUTIVE FORUM

As a matter of fact, if it is borne in mind that the main essential in any profitable venture is to assure oneself of the collection of all items of expenditure into a cost upon which the sales price is set in such a way as to insure a profit, the actual method of setting up an overhead is not of any great moment. On such a basis, it doesn't matter much whether direct labor is used as the foundation or some other element in the cost. The establishment of such a basis is intended merely to simplify figuring, since it is easier to make all calculations upon the basis of some regularly used element.

It naturally is a good thing to have overhead in any form as a sort of mark to shoot at in a program of operating efficiency, but to believe the worst merely because the figures top some arbitrary limit, is to restrict the very sort of development which any business needs if it is to remain healthy. —D. C. WRIGHT.

Too Much Inspection

The question of the quantity and type of inspection depends on the type of industry. Inspection problems in assembly industries are of a somewhat different character from inspection problems in continuous industries. In the manufacture of paper, textiles, and chemicals, a defect in manufacture is likely to make the material a second. Thus the duties of an inspection department in such industries include the prevention of defects wherever possible, the noting of defects after they have occurred, and the decision as to whether such defects may be remedied or whether the goods must be placed in a lower classification of product.

In assembly industries, inspection includes attention to accuracy of manufacture and to interchangeability. In some, inspection is so important for the following operations that it is regarded as an operation. Certainly some inspection must be made as a final operation when the product is finished, to prevent the time of the assembly workers being taken up by rejection or fitting of parts. Perhaps inspection must be made after each operation. Between these two extremes lies the usual situation. Very often a series of operations can be grouped satisfactorily and inspection made only at the end of each of these groups. Such grouping however, requires care for best results.

In the case of products manufactured largely through the skill of the workers, much more of the product must be inspected than in the case of the product which, when set up, is likely to be turned out in a satisfactory manner for a considerable time without adjustment. In the latter case inspection must be made frequently enough to ascertain that the operation of the equipment is satisfactory and that no adjustment is needed other than the usual adjustment made by the worker on the job.

Much of the success of the inspection department depends on the individual inspectors. They must co-operate with the foremen in eliminating causes of rejection, and must take defects back to the individual workman who caused them. Such methods tend to make the workers their own inspectors and make possible a reduction of the inspection force. The inspector can do much to build up the reputation of his company for high class products, and can do much toward keeping the production efficiency up to par.

—B. SLADEN.

Vacations and Bonuses

Scheduled production is difficult to maintain, and the established teamwork is interfered with when vacation periods are scattered. Alternating absences demoralize the force.

The plant can produce more if it runs continuously and closes down a specified number of days for the vacation period, during which time maintenance repairs and machine changes and improvements can be made. The idea is to have everybody, both in plant and office, take their vacation at one time, so that a continuous upheaval from June to October can be avoided. At the end of this simultaneous vacation, the whole organization returns to office and plant with renewed vigor, ready to jump into another year's work. Thus much of disruption, confusion and waste which existed through the four summer months, when the employees were alternating on their vacations, is eliminated.

The men should get paid for their vacations. One plan of wage payment for vacations is to pay the men according to their length of service; two days for every year of service, with a maximum vacation of two weeks.

G. H. GUNN.

How Much to Invest in Fixtures

Temporary tools should be used until the new line has been perfected as insurance against errors in design and against mistakes in choosing manufacturing methods. Very frequently permanent tools have to be scrapped when the discovery is made that certain parts can be made better or cheaper by methods different from those decided upon before production was started.

It is erroneous to assume that the money spent for temporary fixtures is a total loss, for they can be retained to maintain production when the regular tools are being repaired or overhauled. In many instances they can be so designed that a slight additional expense will convert them into permanent tools. —H. C. KLINE.

The Customer Always Pays—*Discussion*

By D. C. Wright

THE writer has read with interest and entire approval the editorial in the August 30th number of the *Machinist* under the above heading.

As an industrial executive on the receiving end of a good many sales contracts over a period of some fifteen years, and at times having acted on the opposite side of the proposition, I thoroughly agree with the idea that only a very small amount of the effort and expense involved in forming direct contact with prospects or customers actually could be counted as useful work.

All along the line, from the time that a contact is planned until the final interview, at which the proposition in hand simmers down to "yes" or "no," there is costly delay involved.

Also, there is no doubt in the writer's mind but that under the better informed and progressive program of modern salesmanship, involving as it does a very definite interchange of worth-while information and constructive ideas, even where actual sales are not made at the time, there is a very definite value to be derived by the "callee."

Just what the cure for this phase of the question may be, I am not qualified to say. Mayhap, the selling companies will in their turn have to be a little arbitrary and "hard-boiled" in squandering their representatives' time and effort at the whim of some prospects and customers. More likely, it is going to be a case of gradual education through the various useful trade associations, publications and other sources of general trade education; the final object being to win a little more co-operation and appreciation of values involved on both sides of any sales or "missionary" contacts.

Another Phase of the Subject

However, while we are on this subject, there is another phase of the matter, with which I have come all-too-frequently into contact, and which I feel could be very profitably considered by those companies having local representatives in certain centers.

At least three times during the past month, and on an average of at least the same number of times over the previous months, our company has had occasion to go afield for certain advertised articles. In each case, the information conveyed in the advertising matter on hand has been sufficiently clear to permit an intelligent engineer or technical expert in the line concerned to judge of the wisdom of making an application of the article or process involved.

Accordingly, letters have been dispatched to the office address of the company concerned, asking quotations or making inquiry as to certain specific data desired.

In each case, the questions were explicit and the desire for an immediate reply expressed. Yet, in nine cases out of ten, instead of replying promptly, giving the information desired, there has come back in the course of several days a brief note, worded about as follows:

"Your communication of the 20th, addressed to our office, has been referred to the writer. We have a Chicago office, located at 18 Blank Street, in charge of Mr. So-and-So, to whom we are taking the liberty of referring your kind inquiry. You will hear directly from Mr. So-and-So, whom we have asked to call upon you, at which time he will be able to give you whatever information you may desire."

Now, while that is not verbatim, it is typical of dozens of letters that have come to the writer's attention, and serves to illustrate my point.

Here is a case of a potential customer, gathered into the fold through the medium of advertising, who is already practically "sold" on a proposition and merely wishes to secure a few simple facts upon which to base his action. Instead of replying to the plain question asked, sending, if need be, a copy of such reply to the Chicago representative, but saving his time and giving the customer prompt service, what happens?

The Chicago representative, having as a rule a considerable territory to cover in a very sketchy way, largely because of the very items brought forth in the editorial, may not have the opportunity to make the call on the prospect for several days. The prospect wants action, does not particularly wish to take up his time or anyone else's in a lot of sales talk, or even in getting a reply to the questions on a few items of data needed to work out the problem in hand.

As a result, he is more than likely to drop the subject at once and proceed along other lines in solving his trouble; and, if he does await the call of the representative, he does so in a state of irritation, bred of the delay and needless time involved, and at best is not in a particularly receptive mood when the caller finally does put in his appearance.

It is obvious that in cases where a company has local representation the man in the particular district would be informed as to any developments within that territory; but in this day of highly-developed advertising, the prospect's attention is usually directed to the main office under a general company name. Under such conditions, it is only natural that any requests for information should go directly to that address. Why then, in the name of all get out, should such inquiries be bandied around, consuming days of valuable time and reams of correspondence when all of this could be easily saved by direct replies?

It is perfectly logical to inform the local offices, and to direct the customer or inquirer to these local offices; but unless it is absolutely essential for the local man to get on the job, why not leave him out of it and give the customer what he wants for the time being?

Abrasive Materials—*Erratum*

IN THE materials Reference Book Sheet No. 37, on the above subject, published in the issue of July 26, 1928, the sentences beginning on the eighteenth line should read as follows: Synthetic resins, such as the phenol resins, are sometimes used instead of the silicate as binders where greater strength is required than is obtained with the silicate but less openness than with the vitrified. Vulcanized rubber is also used as a binder where high speed is required.

The trade association has been termed the bargain counter of business knowledge, where the individual may exchange his experiences for the wisdom of the entire industry. Through such bodies small firms secure some of the advantages usually inherent in large aggregations.

Inspection Methods and Their Application

By Fred H. Colvin
Editor, American Machinist

Crankshaft inspection involves many factors in addition to diameters of bearings, such as spacing of bearings, balance, and angularity of throws

METHODS of inspecting crankshafts vary widely and depend in many particulars on the design of the shaft and the ideas of both the engineering and production departments. Generally speaking, the inspection is to determine soundness of the forging, hardness of the various bearings, diameter, roundness and parallelism of each bearing, and the length and spacing of bearings. It also determines angularity of the crank throws, position and contour of oil slinger, diameter, and thickness and location of the flywheel flange. Other points are the threaded end of shaft, the oil passages, and last, the running balance, either with or without the flywheel and the clutch mechanism.

There are many methods of inspecting crankshafts. The fixture shown in Fig. 111 is used by the Yellow Sleeve-Valve Engine Company on one of its four-throw crankshafts. This fixture permits the inspection of many parts which will be described in detail. Beginning at the left, the threaded end is inspected either by a ring thread-gage or thread snap-gage, while the diameter of the part between the thread and the end bearing is shown by the movable plunger *A*, controlled by the lever shown at the end. Tolerance marks indicate the diameter of this portion. The two end bearings rest in hardened V-blocks of uniform height, and so hold the shaft parallel with the base of the fixture. V-blocks, however, are not found as satisfactory as rollers, owing to their tendency to mark the bearings as the shaft is revolved. In Fig. 112 the roller bearings are shown in use.

The first part of the eighth article. The concluding part will appear in an early issue.

With the crankshaft in the position shown, the gage *B*, Fig. 111, locates the first crankpin in a vertical position by spanning both the pin and the hardened steel block beneath it. The lower block also checks both the length of the crankpin bearing and its endwise location with regard to the other bearings. A similar block is shown at *C*, while at *D* and *E* are length gages that check the length of the plain portion at the left end of the shaft and the length of the first main bearing, respectively. The center block *H* locates the position of the central bearing, while the dial indicator on the surface gage *I*, is used to indicate its alignment with the two end bearings.

The alignment of the second and third crankpins can be checked by means of the blade of the height gage as at *K*. The blade is set against each side of the pins alternately, the alignment being checked by its contact with the pins and the steel blocks under them. The flange diameter and thickness, together with the oil slinger ring are checked by snap and contour gages in the usual manner. Bearing diameters are frequently checked with micrometers at each end and in several positions, in order to find any "out-of-lineness" that may exist.

In some shops the exact diameter of each bearing is indicated by charts, so that the assembler can readily select the proper part to fit it. In other shops where this selection is not considered necessary, the bearings are simply inspected either with the micrometer or by go and no-go gages, so as to be sure that the diameters come within the prescribed limits.

The method of testing the squareness of the crankpins with the main bearings, shown in Fig. 112, is also the

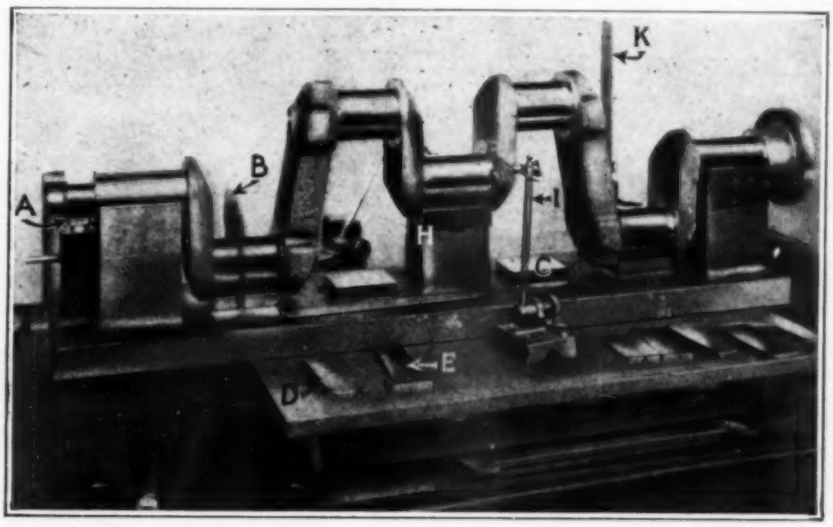


Fig. 111—Fixture in Yellow Sleeve-Valve Engine shop for checking various dimensions on a four-throw crankshaft

The various parts of the fixture check the length and location of bearings, angle of crank throws and other points

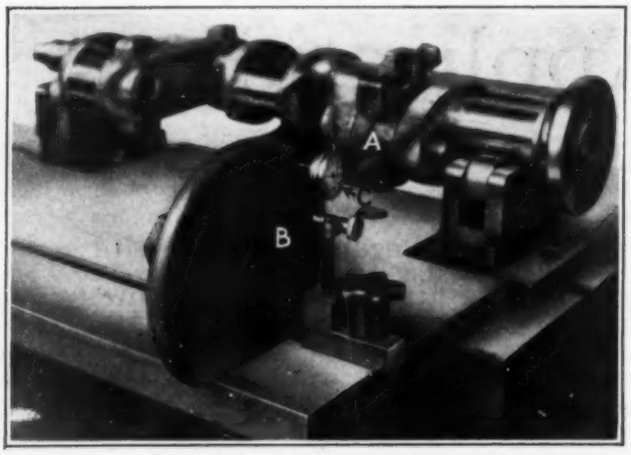


Fig. 112—Checking the alignment of the crankpins with the main bearings. Crankshaft rests on roller bearings and a test rod having a large disk is placed on the pin. Turning the crank moves the disk past indicator and checks the squareness

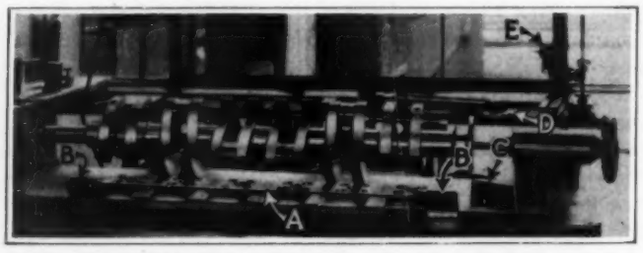


Fig. 113—Testing the Franklin six-throw, seven-bearing crankshaft for location of the bearings, diameter, taper and length of each bearing and general overall dimensions

practice of the Yellow Sleeve-Valve Engine Company. The crankshaft is supported on rollers at each end and a special connecting rod fitted with a quick-adjusting cap, as at *A*, is put on one of the crankpins. In place of the usual piston, the small end of the connecting rod carries a large disk at *B*. This disk is cut off on the lower side so as to slide easily on the surface plate as the crankshaft is revolved. The dial indicator *C* is attached to the surface plate and indicates any departure from squareness as the shaft is revolved and the disk *B* moves past the indicator point.

If the crankpin is parallel with the main bearings, there will be no movement of the dial hand. If, however, the crankpin is not parallel, the disk will not remain square with the main bearing, but will change its angle, so that a very slight deviation can be easily detected. The importance of securing parallelism of crankpins with main bearings can hardly be over estimated, as lack of it seriously affects wear on cylinder bores, crankpins and piston pins.

The Franklin crankshaft has seven bearings and is finished all over. There are numerous inspections before it is sent to the balancing machine. It is mounted on centers, as in Fig. 113, in front of a large window so as to have ample light for checking the various points. Gage *A* checks the endwise position of all the main bearings. The ends *B* fit over the outer bearings on the crankshaft and the five projections fit in between the crank webs, checking the relation of each bearing to all the others. At *C* is a contour gage that checks both the shape and location of the oil-slinger flange. The gage is reversed in the illustration. At *D* is a go and no-go snap gage for checking the flange thickness, and at *E* is one of the dial gages used for checking alignment of pins and bearings. Crankpin, main bearing and flange diameters are all carefully checked.

In Fig. 114 a scleroscope is being used to check the hardness of all the bearings. Each bearing is tested at several points on both its length and diameter. The case-hardened crankshaft of the Franklin motor gives a very hard surface, and great care is taken to secure uniformity in the hardness of the different bearings. The gage *A*, standing on the window-sill, checks the endwise location of the various crankpins in the same way as the similar gage shown in Fig. 113 checks the position of the main bearings.

Another method of inspecting crankshafts is illustrated in Fig. 115 which shows the shaft of the Marmon-8 being inspected. The inspection fixture is mounted on the heavy baseplate *A* and has two pairs of shaft supports, so that two inspectors can be at work at the same time. Among the inspections performed with the shaft in the front position, are the keyways in the end, which are tested by the gage *B*. Blocks *C* can be arranged to check the accuracy of the throw angle, using the base of the fixture as a surface plate. The plug gages *D* check the hole in the end of the crankshaft and the bolt holes in the flange. In the fixture at the rear, the shaft is supported in half bearings instead of in V's. The strips *E* check the endwise position of the various crankpins as the shaft is revolved, while supports as at *H*, carry plugs that contact with the crankpins in their outer position, and so check the throws. Micrometers for flange diameter and other parts are shown at *J*, while the gage *K* checks the spacing of the holes in the flange, so as to be sure that they will match those in the flywheel when these parts come together in the assembling department.

Cleaning and testing oil passages in crankshafts is one of the important operations. In the Pierce-Arrow plant, the passages are first blown out by air pressure as shown in Fig. 116. They are then tested by forcing oil through

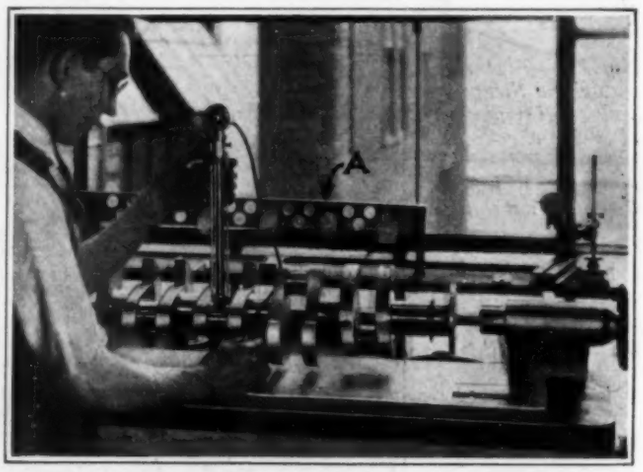
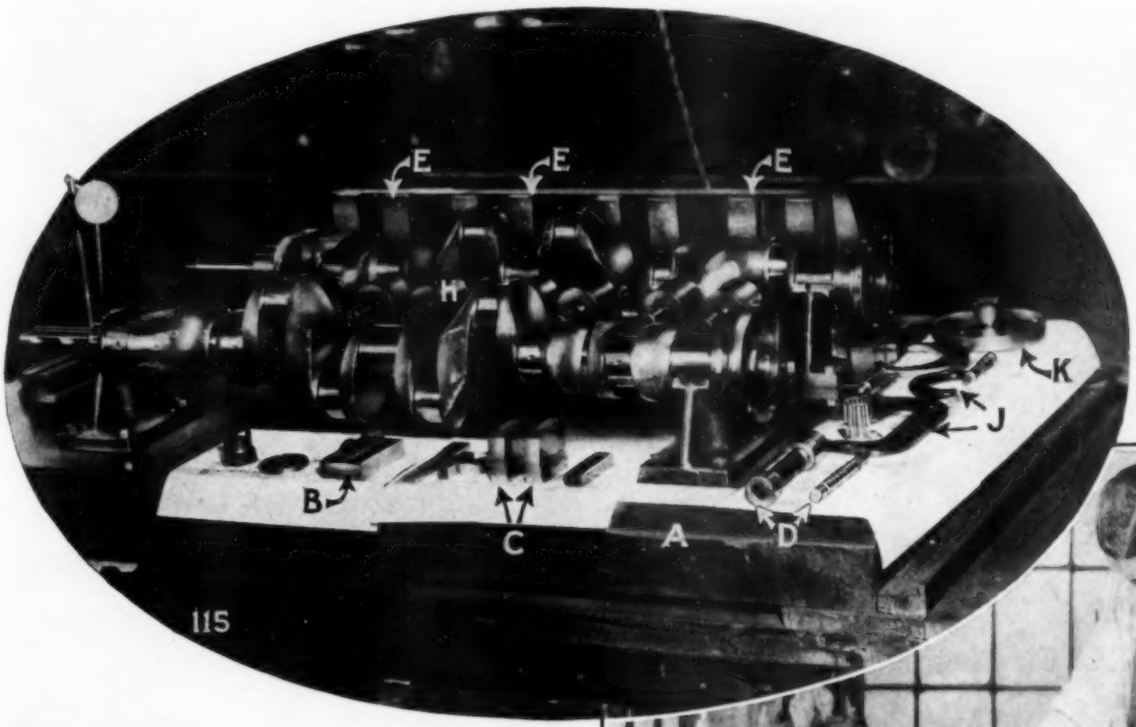


Fig. 114—In addition to checking every essential dimension on the crankshaft, the hardness of the casehardening is tested at several points on each bearing. The inspector becomes very expert and tests it rapidly



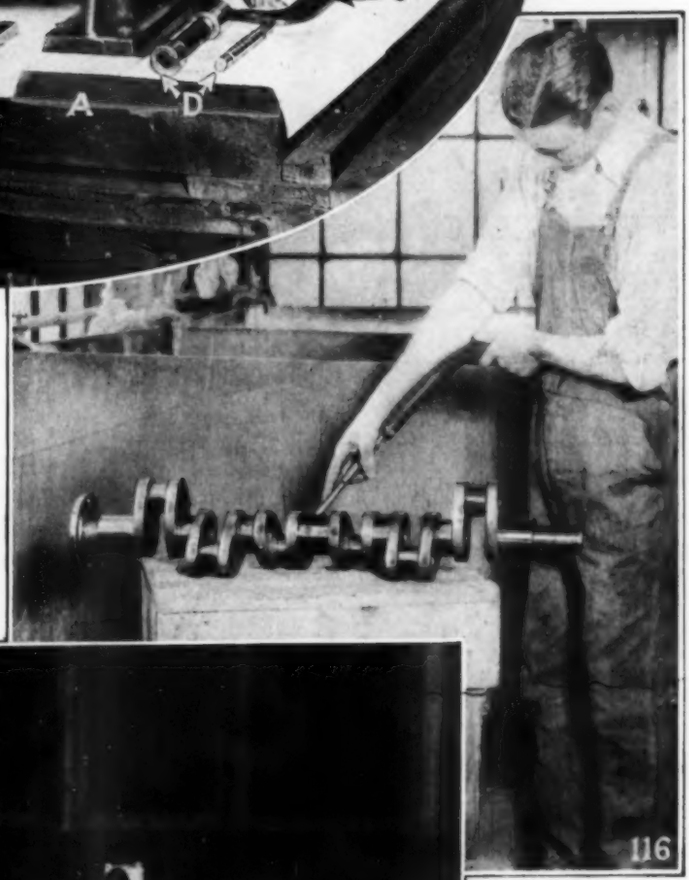
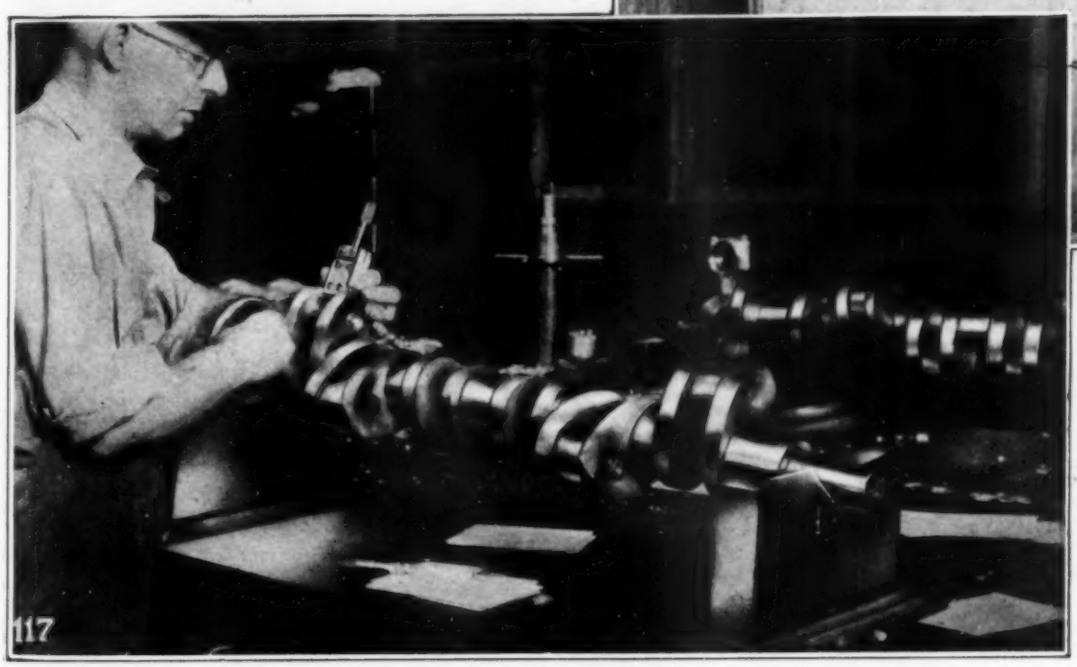


Fig. 115—Marmon fixture for checking a complete crankshaft. Here diameters, length of bearings, angularity of crank-throws, depth and size of keyways, flange diameters and other essential dimensions are tested at one setting

Fig. 116—Blowing out the oil passages in a Pierce-Arrow six-throw, seven-bearing crankshaft

Fig. 117—Checking a six-throw crankshaft in the Pierce-Arrow shop. The shaft is mounted in wooden Vs and the various bearings are measured for diameter, radius of fillets, and the distance between the cheeks



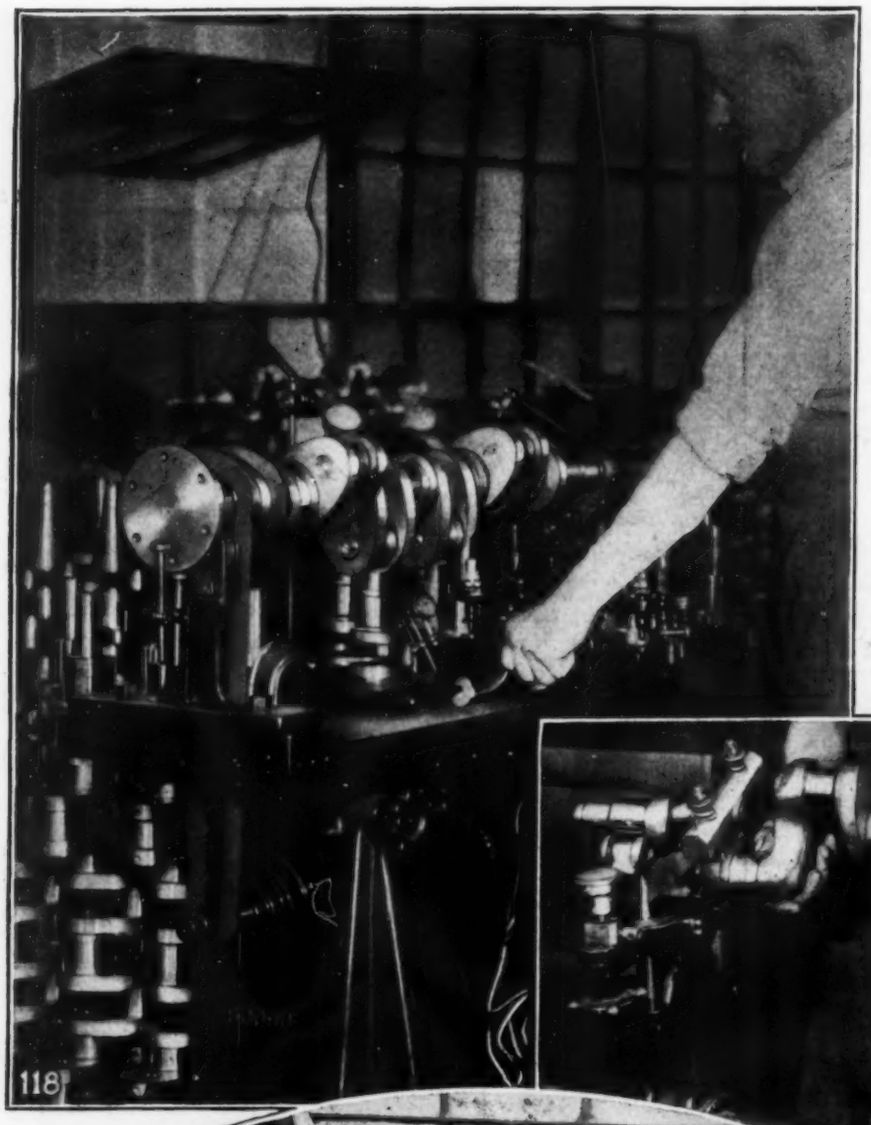
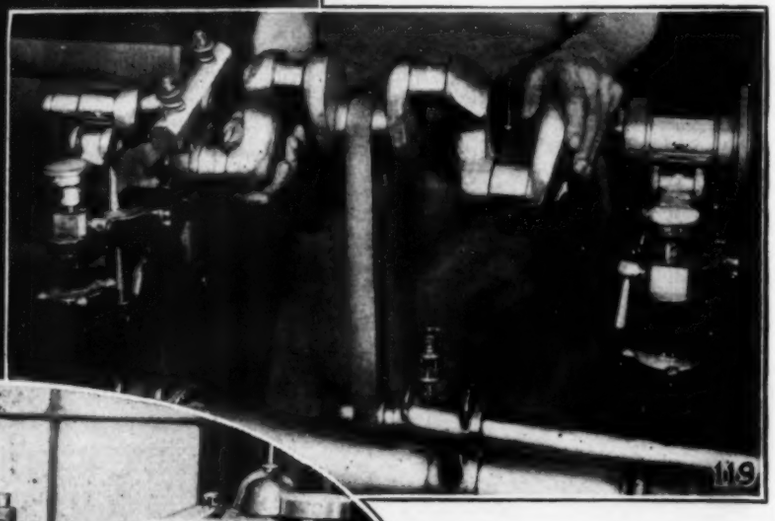


Fig. 118—After inspecting the various dimensions, the crankshaft is tested for balance on the machine shown. The shaft, mounted on rollers, is driven by an endless belt, and the vibration is noted. The amount of metal to be removed is shown by the weight necessary to balance the shaft

Fig. 119 — Another method of balancing crankshafts. The shaft is driven from its center bearing with the end bearings resting on rollers. One of the balancers is shown at the left. The dial gages at each end show the amount of vibration, if any



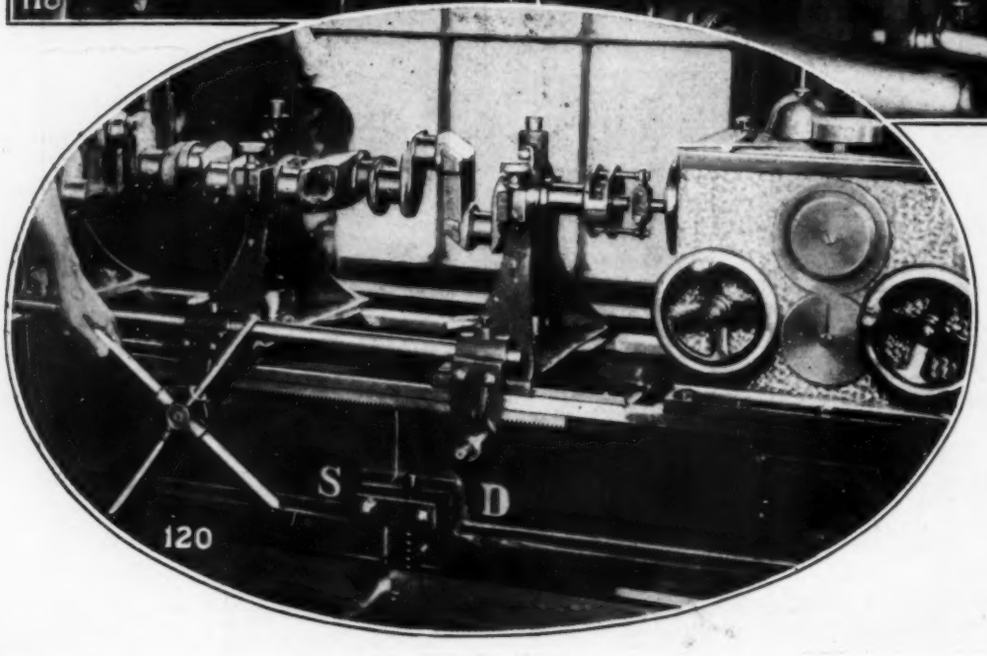
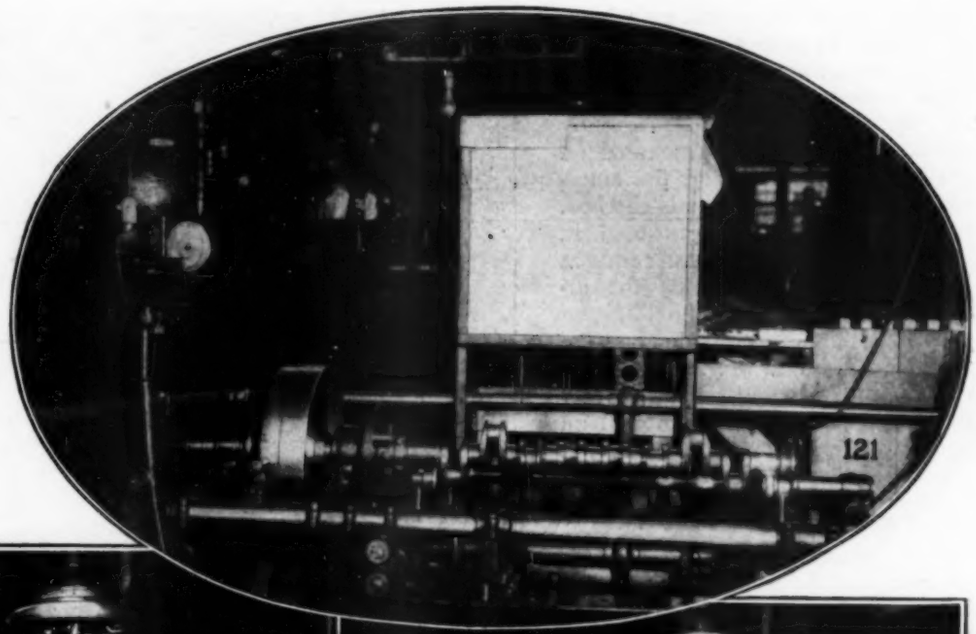
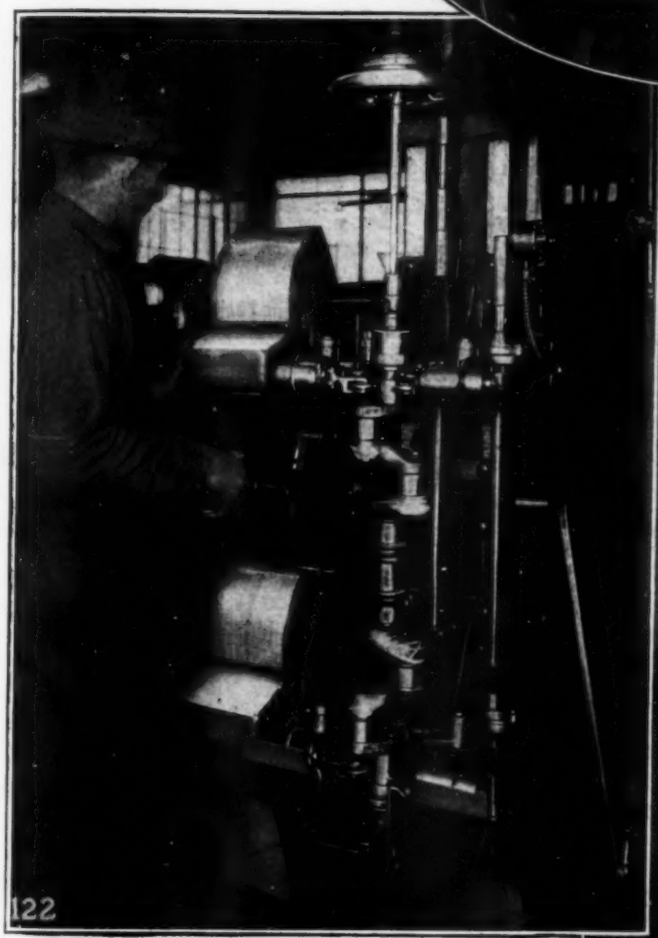


Fig. 120 — An eight-cylinder Lycoming crankshaft being balanced on still a different machine. The shaft is held in plain bearings and is driven through a flexible coupling. The vibration is checked by the dials at the right

Fig. 121 — Using a precision balancing machine in the Stutz shop. The necessary data for checking and correcting any out-of-balance is contained on the chart behind the machine

Fig. 122 — A vertical balancing machine designed by the General Motors group, being used on an Oakland crankshaft. Driven by a universal joint and supported in rollers at each end, the vibration of the shaft is shown by beams of light across the charts





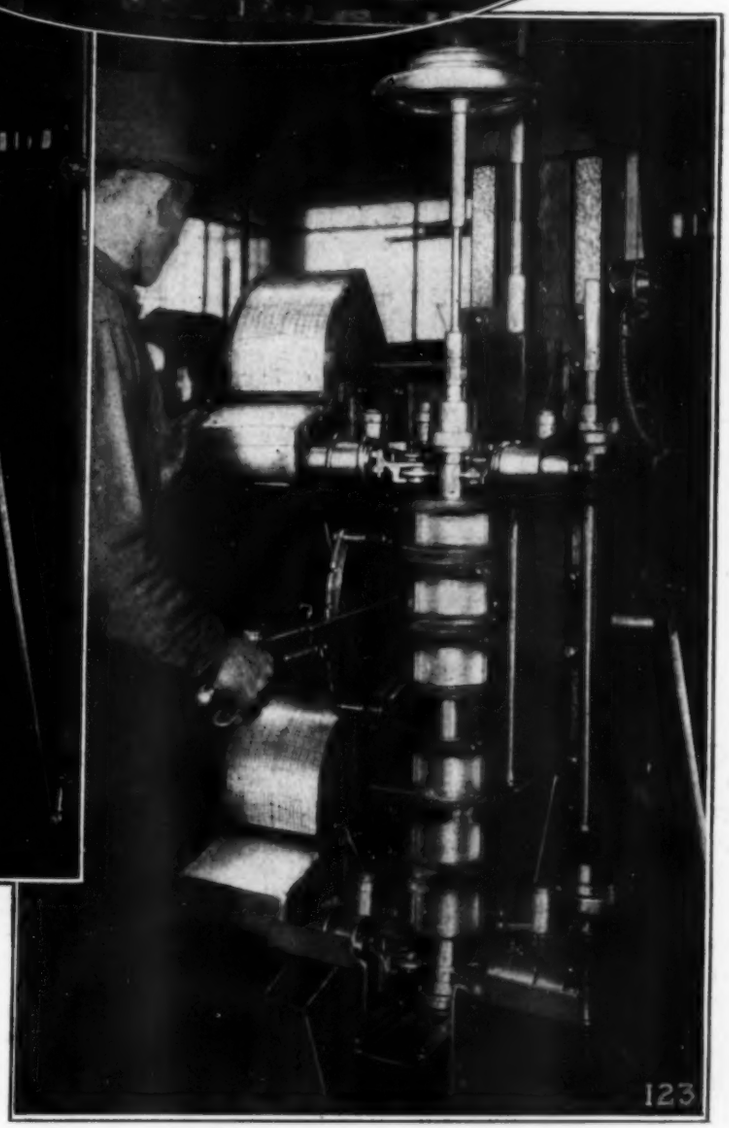


Fig. 123 — The same machine with the shaft in motion. The sharp outlines of the three bearings show the lack of vibration in the crankshaft as a whole. The machine can be operated very rapidly and has proved satisfactory in actual practice

them so as to insure that each bearing will get its proper supply of oil.

The various diameters, of both main bearings and crankpins, as well as their lengths, are carefully checked. The shaft is mounted on the bench, Fig. 117, and the angularity of the crank throws is checked. One of the special gages used in checking the length of the crankpin bearings is being used by the inspector.

Testing for balance is done on the machine shown in Fig. 118, which checks the running balance after standing balance has been tested on parallel ways in the usual manner. As will be seen, the crankshaft is finished all over, including the turning of the outside of each crank web.

The balancing of crankshafts is another step in inspection in which there are wide differences of opinion as to methods. It is generally conceded that static balance is not sufficient to secure a smooth-running, vibrationless engine, particularly in these days when speeds up to 4,000 r.p.m. are not considered excessive by some designers. After static balance, for this usually comes first even with the use of dynamic balancing machines, the crankshafts are balanced in motion on machines of several types. One of the early machines was the Norton, which is shown in Fig. 119, balancing a crankshaft in the Oakland shop. A crankshaft with a balancing device, or harmonizer, in place on one of the crank webs is shown in this illustration.

Another type of machine built by the Tinius Olsen Testing Machine Company is shown in Fig. 120, while a third type known as the "Precision," developed by the Gisholt Machine Company, is shown in Fig. 121. An entirely different type of balancing machine has been developed by the General Motors Company, the one shown in Figs. 122 and 123 being from the Oakland plant. In this machine the crankshaft is held vertically, and is driven from above through a universal joint, the upper and lower bearings being supported between narrow-faced rollers. The supporting rollers are spring mounted, so that any vibration due to lack of balance is transmitted through suitable multiplying mechanism, and the vibration of the shaft is indicated by light beams, which are shown in the instruments in front of the operator. The speed of the shaft is controlled by the operator through a lever and the variations in the light beams tell him where metal must be removed to secure accurate balance, and also how much. The crankshaft is shown in rotation in Fig. 123, and the sharp outlines of the center bearing indicate that the balance of the crankshaft must have been practically perfect when the photograph was taken. Stutz crankshafts are balanced on a Gisholt precision machine, as shown in Fig. 121. A detail view, showing how the crankshaft is supported at the end, is given in Fig. 124, and a closer view of the indicating mechanism is also presented.

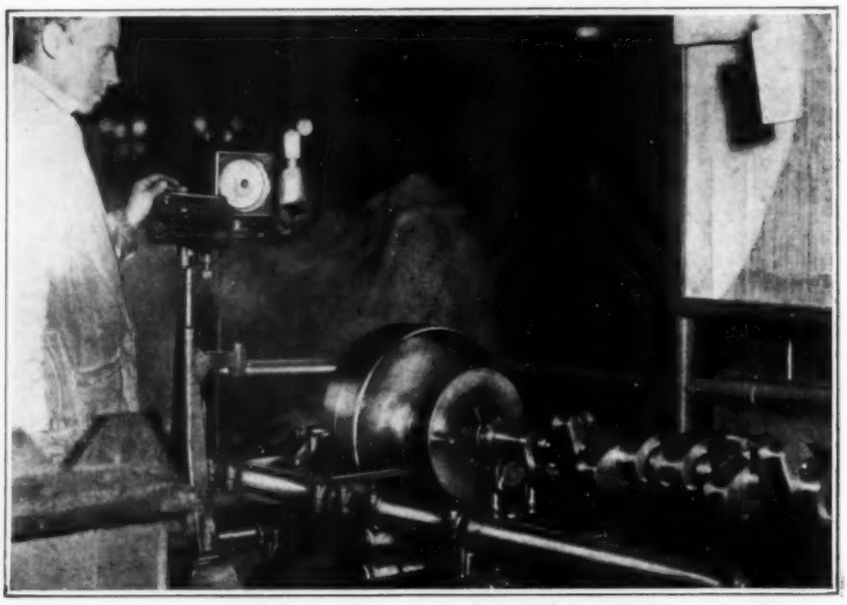


Fig. 124 — Close view of the mechanism, shown in Fig. 121, that indicates the amount of correction necessary for balance. This view also shows how the shaft is supported on rollers. It is driven from the pulley

Progress and the Engineer—*Discussion*

By J. J. Provost

SIR JAMES ALFRED EWING is quoted, on p. 383, Vol. 69, of the *American Machinist*, as having prophesied that there would be a lull in the revolutionary progress of mechanical inventions, and that public minds would probably be turned to the ethical side, and to the improvement of personnel in the immediate future.

To my mind, an executive that would accept the above prophesy, regarding a lull in the revolutionary progress of mechanical inventions, literally, would be in grave danger of being left at the post. I believe that we have only scratched the surface of mechanical inventions, basing this opinion on the progress made in the past, and on observations and studies of present machines and products.

Continuing the above-mentioned quotation, we read that we can, however, expect improvements in air travel, that communication may be extended to include vision, and that power will certainly be more generally distributed. Certainly if power is to be more generally distributed, many new uses for the same will be found. New standards of living, involving changed home design, and radically new appliances as well as manufacturing processes are to be expected also.

Again, our present modes of overland travel will change and improve more in the next twenty years than they have in the past thirty. And here I venture to say that the present automobile engine will before many years, be considered a very crude affair.

· THE · FOREMAN'S · ROUND · TABLE ·

The following narrative is a "case" presentation of the topic. It has been written to involve some of the questions that arise in the average shop. For guidance in preparing discussion the questions at the foot of the page have been prepared

The Boss's Son in the Shop

"MY OLD friend Joe Lamont tells me he's just had a new apprentice wished on him. It's the son of the big mogul of the whole works." Said Ed, gossiping with Al on the way home.

"Nice prospect for Joe, eh, Ed. Nursing along the son of the big boss doesn't appeal to me at all."

"But he isn't supposed to do any nursing, Al. The big guy gave orders that the boy was to have no favors. Wants him to win on his merits or work out his own salvation. Wants a report every month so he can keep tabs on the boy, but doesn't want anyone to know that he's the son of the great mogul."

"Swell chance of keeping it dark, I'll say, Ed. The old man may be honest in wanting the boy to make his own way. But it just can't be done in his own shop."

"Oh, I don't know about that, Al. Everyone needn't know who he is."

"Don't kid yourself, Ed. You know darn well it will get all over the shop in a few days. Those things spread like wildfire. And the boy just can't be the same as though he was in another shop."

"But he isn't to have any favors, Al."

"He can't help it, Ed. If you had him in your department you know you'd be thinking about him a lot more than if he wasn't related to the big boss. You might not mean to favor him, but you would. You'd know that the old man would be sure to hear about how you treated the boy. And you wouldn't bawl him out as you might a stranger, no matter what sort of a fool mistake he made."

"But how is the boy going to learn about the business, Al?"

"He can learn about it in his dad's plant if he wants to, and has the right stuff in him. But he'll do a lot better to go to some other shop for the first year or two. This business of treating him like any other apprentice is all bunk, Ed. It can't be done. The old man might be able to do it if he was in the shop himself. Maybe. But no foreman can forget who the boy is for a minute. He'll be thinking of how his treatment of the boy may affect his own job some of these days. He can't help it."

"Perhaps you're right, Al. But it looks as though the big boss wanted to play fair, Al."

"I don't doubt it, Ed. But he's either been out of the shop so long he's forgotten how things work, or else he never worked in a shop at all. The boy will get a lot better start in some other shop in some other town. And the foremen in his dad's shop will be a lot happier if the boy is in some other shop."

Is Al correct in feeling that the boy cannot be treated as an outsider? Or is Ed's idea that as long as his dad asked for no favors he'll be like other boys? Should he go to another shop?

All foremen are urged to discuss these questions vital to their work; of course the

discussion is not limited to foremen. Letters accepted and published will be paid for

Discussion of Earlier Topics

Holding Back on Piece Work

HOLDING out on piece work on good days isn't an unusual practice by any means, but I believe it is a diminishing practice, due to the ever increasingly better relationships between employer and employee. After all, the men's action in such a case is but a direct reflection of the management's attitude in the matter. When increased production means a cut in the piece rate so that harder work for the same pay is the reward of initiative, when the maximum day's run under extremely favorable conditions becomes the basic standard for setting rates, then you have the men endeavoring to play the same game.

When an improvement in mechanical equipment appears to justify a lowering of the piece rate, it should not be done arbitrarily, but the men should be taken into the management's confidence, the increased investment in new equipment explained, and the saving split with the men in fixing the new rate. The men always are anxious to meet the management half way in these cases, for holding out piece work is far from satisfactory to them.

—JOHN L. STARR.

Equipment and the Foreman's Reputation

BILL JENKS should have stayed on the job. As foreman of the Metal Fittings Company it was his work to show a profit to the "old man," and in failing to do this he brought the "old man" on his "neck." Had he given the subject more thought he not only would have told the "old man" his machinery was losing money —he would have *showed* him it was. This could easily have been accomplished by Bill by preparing charts or plain figures showing how much a piece would cost to run on the old machines and then tabulate the cost on the new machines. It has been done before, and Bill could do it too—if he hadn't quit. —NIC L. SCHMIDT.

QUITTING the job because the boss will not buy decent machine equipment is not a satisfactory solution to the problem from the standpoint of the employee. It would be more conducive to the correction of this defect in factory production, if the effect of the bad equipment on production be brought to the attention of the management. This can be done if it is shown that an inferior and more costly product is manufactured, the inferiority and expensiveness of which is due to the use of improper equipment.

The foreman's reputation will not be damaged if the fault is in the equipment. The foreman should run the machines, but should bring the matter to the attention of the proper authority. The management should be made to realize that it is losing by having to use this defective equipment. Mounting costs and inferior production should convince every progressive manufacturer of the detriment accruing from the use of bad equipment.

—A. DAVIDSON.

THE·NEXT·TOPIC

Asking a Man to Come Back

ADVANCE QUESTION

Ed has fired a good man for something he didn't do. Al advises him to eat humble pie and ask him to come back. Ed thinks it may affect discipline. Who is right?

Putting One Over on the Builder

AL WAS wrong in bawling out Parker who may have other suggestions in mind in the future that would really benefit the firm. Now he will refrain from making them, feeling that he would meet with the same rebuff. Al would have done just as well if he had simply told Parker that he did not approve of anything like that and left the matter drop. To bawl a man out when he means well is poor management. It takes time and effort to get the employees working for the interest of the firm, and a quick tempered foreman can in a very few minutes lose all of the good will that it took the management months to gain. —WILLIAM J. OWENS.

Reading the Shop Language

THE practice of having machine operators read blueprints differs. In some shops, machine operators are supposed to be able to read blueprints. In others, they are supposed to work to a sample or model, and when it comes to working from blueprints, the foreman or his assistant does the reading for them.

Every man or boy who works in a machine shop or toolroom, whether he is a machine operator or not, should be able to read blueprints, for reading blueprints is one of the necessary accomplishments that goes hand in hand with modern machine shop practice.

Ed has truthfully said that blueprints form the language of the shop, and I would like to add that without a thorough understanding of that language the chances for promotion in any modern machine shop are few and far between. —CHAS. DOESCHER.

The Toolroom

Its Relation to the Purchasing Department

By D. C. Curtis

Chief Purchasing Officer
Chicago, Milwaukee, St. Paul and Pacific Railroad

A knowledge of costs, and of the problems and routine procedure of the purchasing department, will help the toolroom in extending its share of the needed co-operation

IN ARRIVING at standardization, it is very important to comply with commercial practice. It may seem much better to design something that fits a particular purpose and not take into consideration the commercial viewpoint. However, manufacturers must design so that their product will be used in sufficient quantities to justify mass production in its manufacture. Therefore, as far as possible, users should standardize on commercial products, rather than special designs, if they are going to enable the purchasing agent to buy material at a reasonable price.

The toolrooms, in themselves, do not use sufficient tools to make it profitable for manufacturers to turn out special tools. On the other hand, with their ingenuity and practical experience, they can in most cases, by working with the manufacturer, obtain a tool at a reasonable price. It pays to give information to the manufacturer, as in many instances he is able to make suggestions as to improvement both in quality and price, and still furnish a suitable article for the work required.

The tendency of designers is to make tools so good that they will not wear out. This practice is not always sound. A tool should be made so that it will produce a profit for its user. It should be made to last only a reasonable length of time, and should be able to pay a dividend in that time. Some of our most successful users of tools, particularly for mass production, build their tools for a life of five years only, and the tools must pay sufficient dividends to be written off in that time. Having a tool built so that it will pay dividends in a short span of life, makes it possible to take advantage of improvements. Or, if conditions change so that the tool is no longer needed, the investment is paid off and the tool can be scrapped without criticism.

Cost of Material Lying in Stock

There is a tendency, also, to purchase tools for mass production where mass production is not required. This practice not only increases the cost of the tools, but in most cases increases the cost of the work performed on it, on account of the time necessary to make the changes in set-up. The storekeeper often hears the complaint, in making requisitions for small quantities of material, that it costs more to change the machine than to perform the work, and the shops ask for a large order so that the work may be performed cheaper. The authorities give, as a minimum, 15 per cent as the charge for carrying material in stock. This is very conservative, so that where material is manufactured or turned out on the machines in larger quantities than use demands, there is a carrying charge of 15 per cent to be added to other costs of material. The toolroom should be sure when it receives a request for a tool for mass production, that mass production is going to pay

The purchasing agent requires, and should have, for the purchase of tools, a requisition that is complete with all information, including size, make, design, use, material best suited to its construction, estimated cost, names of manufacturers making the tool, length of life desired, and wearing parts that will require spares. The purchasing agent deals with many thousands of items, and if he is to protect the interest of the toolroom, he must be furnished with ammunition to deal with the seller.

The purchasing agent requires time, also. Users of material are so in the habit of going over to the storehouse with a requisition and bringing back the material, that they are surprised if the storekeeper asks them to think ahead and plan their demands so that sufficient time may be had to supply the material needed. The section stockman has several thousand items of material to look after. On each one of these items, he must find the quantity on hand, the quantity due, the quantity held for orders, and the quantity used during the last ordering period. For each one of these thousands of items, he must write the requisition, and send to the general storekeeper for checking and authority.

To make the purchase, the purchasing agent sends out an inquiry with the detailed description of the tool. The manufacturers and jobbers then work up their bids, based on the information on the inquiry. After the bids are submitted, representatives make personal calls, explaining their bid in detail and adding all the arguments they have, why their particular tool should be purchased.

Value of Knowing the Purchasing Agent

The toolrooms should make it a point to know their purchasing agent and have an occasional visit with him. It is much easier to discuss problems across the table than it is by correspondence. By getting acquainted with him, he is better able to have the toolrooms' viewpoint, and better able to serve their interests. The purchasing agent has a desire to purchase what the toolroom wants but he is also vested with the responsibility of conserving the company's money, just as far as it is possible to do so, and still furnish an article that will do the work required. Therefore, the purchasing agent must have sufficient knowledge to know whether the manufacturer is offering an article too cheaply made on the one hand, or too elaborate and high priced on the other haud.

It is very essential that men of the toolroom know

Abstract of a paper presented before the sixteenth annual convention of the American Railway Tool Foremen's Association, Sept. 12 to 14, in Chicago.

the cost of tools. It is necessary to consider the cost of the land, cost of the building, taxes, insurance, repairs, obsolescence, interest, cost of power to drive, and all the other factors of the movement to and from the tool itself, of the material that is to be worked. In most cases the transportation cost is more than the cost of operation of the tool. It is very essential to know all the costs, and to take into consideration all the factors before ordering the purchase of new tools. By having this information, the toolroom prevents embarrassment to itself and is sure that its order is not going to meet any opposition.

Benefits of the Dollar-and-Cents Limitation

I am a firm believer in dealing on a dollar-and-cents basis, rather than in terms of performance. The thing that counts is the amount of money in the treasury. We can keep money in the treasury only by spending where more is produced than is taken out. To do this we must have the dollar sign pasted on our design, and the dollar sign pasted on the work to be performed. The dollar limitation always forces better tools and cheaper work, as it forces closer supervision.

I am also a firm believer in the budget as a means of control. If a toolroom is given a certain amount of money to spend, and told that it is all they can have, the same as each one of us do in our personal account, then it will spend that money for tools that will produce the greatest revenue to the company, and the best showing for its individuals. A railroad, like an individual, has a limit to its income. It has more requests for expenditure than dollars to spend.

Requisitions for tools, replacements and repair parts should be budgeted and consolidated as much as possible. It is much easier to get a good price on quantities than on individual items. In addition to that, it is possible to get a better product, as the larger the purchase, the more time is spent in its purchase and the greater the desire of the manufacturer to furnish the most acceptable product. The American manufacturer is a mass production man and relies on mass production for profits. Requisitions should be sent in from all parts of the railroad at one time, monthly, quarterly, or bi-yearly, as the needs demand, in as near one unit as possible. This enables the purchasing department to benefit by quantity purchases; makes it worth while for a competent supervisor to go over the order and give the tools inspection; reduces handling and checking in the storehouse; and gives the toolroom an opportunity to substitute new tools for old ones at the points where they will do the most good, and forward the old tools to points where the service is less severe.

By this method it is possible to spend the money that is allotted for tools, most advantageously.

In modern purchasing the tendency is to specify clearly and thoroughly what is wanted, even in the case of so-called standard items. When the seller knows exactly what is required, the responsibility of satisfactory delivery rests on him, and he has no excuse for tendering unsuitable material. The most complete specification, however, provides no assurance that the proper goods will be forthcoming. Continued development of purchasing is bound to emphasize the importance of testing as a corollary of purchase specifications. Adequate specifications indicate that the buyer knows what he wants; adequate inspection insures that he will get what he wants.

SEEN · AND · HEARD

By John R. Godfrey

Total Costs and Savings—Gages—Accurate Indexes

WHEN it comes to jumping at conclusions, most of us stand fairly high in the athletic class. We read of some wonderful new machinery by which 33 men do the work of 480, and we start to figure savings on this basis. We are very apt to overlook the huge initial investment and the interest that must be charged against it, to neglect the amount that must be set aside for depreciation and upkeep, and to quite forget how the losses pile up when all this new machinery stands idle from any cause whatever.

I am not decrying the new machinery and methods—we need them all. But don't let us fool ourselves as to the real results and what they cost. Figures and percentages are useful in their place, but they can lead us a merry chase unless we display considerable horse sense when we try to use them.

* * * *

There are great differences of opinion as to gaging automobile cylinders. Gages of all kinds have been designed and used; gages with dials, multiplying levers and various devices, not only to check but to measure the bores at various points. And yet one of the largest builders of motors has decided that there is nothing quite so good as solid go-and-no-go gages. The gages are made of Stellite about ¾ in. thick, and the cylinders are checked in several positions. The gages are long enough to go through the cylinder bore from end to end and so check diameter, roundness and taper. The inspectors say they are not interested in knowing just how much the error is, but to know whether or not the cylinders are within the desired limits.

* * * *

One of my friends had to have a very accurately-spaced index for a special job. Instead of going to the toolroom as might have been expected, he went to the foreman of the gear cutting department. Telling him what he wanted, he asked him to cut a gear of the desired number of teeth on the most accurate machine he had. His judgment proved to be sound, for he got a remarkably accurate gear to use in indexing.

His theory was that the products of the gear cutting machines were constantly being inspected, and the chances were much in favor of his getting the best job in that way. It may be a good pointer to bear in mind in a similar case.

* * * *

It is a bit queer how ideas seem to run in cycles. Milling cutters, for example, have gone through various stages of tooth spacing, the coarse tooth being the winner to date. Likewise, the feeding of the cutter *with* the work, instead of against it, is being advocated by some well-known users.

In looking over a bound volume of the *American Machinist*, that dated back nearly forty years, I found both these practices advocated by men who are still in the harness. Times change, but frequently the old ideas get a second inning.

A Marked Improvement in Cutting Tools

An abstract of a paper on a tungsten-carbide tool material, together with other abstracts of papers presented, October 8-12, at the tenth annual convention of the American Society for Steel Treating, at Philadelphia

Tungsten Carbide—A New Tool Material

By Samuel L. Hoyt

Research Metallurgist, General Electric Company

IT HAS long been known that tungsten carbide is a hard material; and many attempts have been made to utilize it commercially. The carbide, however, is too weak and porous for most industrial applications of hard materials, and this accounts for the efforts which have been made to increase its strength.

German investigators have been particularly active in this field. One of their important developments is the tungsten-carbide-and-cobalt combination. By means of cobalt, tungsten carbide is made about half as strong as high-speed steel, while retaining sapphire-scratching hardness. These carbide materials* seem destined to play a dominant part in the industrial life of the future. Various forms of carbide-tool materials have been studied by the General Electric Co., both in its research laboratory and in its shops, and it is the experience thus gained which will be described in this paper.

Its hardness can be given in a number of ways. Sapphire is the mineral which comes next below the diamond in hardness. This new material is capable of producing a well-defined scratch in the natural sapphire. A sample specimen ground to an edge of about 90 deg. is capable of cutting a rather deep, narrow groove in an alundum wheel without suffering much loss itself; whereas our ordinary tool materials are worn away by the alundum wheel. The manner, also, in which a sample scratches a plate of glass services as a crude test.

It has been shown that the Brinell number of the hardest steel may be taken as about 1,000, using a diamond ball point as the penetrator. Common hardened tool steel probably runs closer to 850 as a maximum. The Brinell number of the original German material runs from 1,250 to 1,400, and the new alloy from 2,100 to 2,500, so that it represents a material increase over the hardest steel.

D'Arcambal has shown that quenched and tempered high-speed steel has a modulus of rupture, in a transverse or crossbending test, of around 425,000 lb. per sq.in. Similar tests have been run on tungsten-carbide tool material at our laboratory, using a section one quarter of an in. square with supports one in. and a half apart. The German material is found to run around 225,000, while our material runs around 250,000 to 275,000 lb. per sq.in. We have not found it feasible to get a figure for the carbide without cobalt to compare with these figures. It is not likely that a good figure could be obtained, but we may safely say that the pure carbide would come under 50,000. Our experience indicates that such a material would be very weak.

Our work at the Research Laboratory has been largely devoted to a study of the performance of this material as a tool material; hence it is to that particular phase of the work that attention will be called.

Glass proved to be quite easy to machine, or to cut with screw threads; and we soon found that hard porcelain insulators could be machined on a shaper. Hadfield's manganese steel has always belonged to the non-machinable class; but it was found to yield easily to this new tool material, so easily, in fact, that it would seem that the operation could be developed commercially. For a check on the tungsten-carbide material tests, we then tried a standard steel tool on the same material, and found that it lost its edge almost at once.

At one time we attempted to machine a block of quenched high-speed steel on the shaper. We were successful; but the tool performance was not at all satisfactory, for the edge crumbled. The same was found to be the case on several attempts to machine alloys of the cobalt-chromium type.

Performance in Service

In the production of fused quartz, it has been found advantageous to use molds of carbon—the hard abrasive variety. A considerable amount of experimenting had shown that even the best tool steel lost its cutting edge and began cutting a taper, soon after starting a cut on carbon. The difficulty involved in machining a hollow cylinder of carbon may be easily imagined. On putting tungsten-carbide-cobalt tools on this job we found that we could take the entire cut without tool wear, and that the cut was parallel within the tolerance allowed.

Genelite is composed of copper, tin, and carbon. It is so soft, in one sense, that it can be whittled with a knife blade very easily, but it is also so abrasive that a lathe operation dulls a steel tool almost at once. Tungsten-carbide tools were found to machine Genelite, with

*The General Electric Co. has adopted "Carboloy" as its trade name for materials of this type.

no difficulty, and acurate tests of the cuts showed that they were not tapered. A careful inspection of the cutting edge confirmed this observation by showing that no wear had occurred.

On account of the necessity of machining Bakelite at high-speed, diamond tools have been commonly used. This was the only tool material which had been found to stand up at the speeds used, but the diamonds possessed one disadvantage which was overcome by substituting this new material. If the part machined contained a metal insert, a special operation was required to recess this part below the cut of the diamond, for if the diamond were to hit the metal at high speed, it would break off at once. Here the tungsten-carbide tool necessitates no such special operation because it cuts both the Bakelite and the metal insert.

In the "low tensile" field the durability of the tungsten-carbide tools has been found to be of the order of 25 to 75 times that of high-speed tools, or so great that the simplest kind of a test demonstrates the vast superiority of the carbide tool. Here the tool pressure is always light, the cuts are small, and the cutting speeds are high. Resistance to either wear or "burning" is the chief requirement of the tool.

Machining Cast Iron

One of the most difficult jobs to do on cast iron, with the usual tools, is that of removing the surface layer, particularly if the surface contains sand. Castings which would take the edge off high-speed steel almost at once, can be handled with but little difficulty. In fact, we commonly use about the same speeds and feeds on these cuts that are used on the sub-surface cuts. Even cuts which travel in and out of the surface layer cause no particular trouble, and such cuts are recognized as being the most abrasive on the tool.

In the manufacture of armature spiders for electric motors, it is necessary to take a cut over the ribs to true up the spider. This cut is intermittent, and has given us an excellent opportunity to test the behavior of tungsten-carbide tools, under impact. The impact on the carbide tool is generally greater than on the high-speed tool on account of the higher speeds used with the former. In spite of this factor, we find that these tools stand up satisfactorily.

Not much can be said at this time on the use of this material as a finishing tool on cast iron for, obviously, this will require quite a special study. Our work on cast iron has shown clearly that tungsten-carbide-cobalt can machine harder and denser grades than can be economically handled by high-speed steel tools.

Steel is probably the most important and the most difficult field for this new tool material. The difficulties arise mainly from the high tool pressure involved.

Machining Nickel Steel

At one time we ran a series of tests on a nickel-steel test log, the Taylor speed of which was about 54 ft. per min. under our standard conditions for testing high-speed steel. We soon found that, if we were to get any adequate estimate of the life of carbide tools on this log, we would have to increase the speed to around 200 ft. per min. This threw us quite out of the range of speeds used with high-speed steel, and we decided to run the high speed steel under the conditions set for the carbide tools. The calculated tool life came under 30 seconds, while the tool on test failed in 16 seconds, having had its edge burnt off almost at once. The tungsten-carbide tool was then set up in the same way, and after running for one hour, the test was arbitrarily stopped for the tool was still cutting and capable of cutting for a much longer period. One of our test logs is a chromium-nickel steel with a Brinell hardness number of just over 250. With a cut of $\frac{3}{8}$ in. and a feed of $\frac{1}{8}$ in. we find that good high-speed tools fail at 35 ft. per min. in about 6 to 8 min. We run the carbide tools with the same cut and feed, but at 70 ft. per min., and stop the test at 10 minutes. The tools show only slight wear at that point.

This account of the tungsten-carbide-cobalt alloy has shown that its use as a tool material has increased the cutting ability of the tool by a whole order of magnitude. This is the first time this has been done since the introduction of high-speed steel by Taylor and White. Granting this improvement in cutting ability, the extent of the use of tungsten carbide will depend largely on the cost of operating with such tools, and their output, as compared to that of high-speed steel. The ingredients of carbide alloy and the process of making it are expensive, so that we may safely say that it will cost more than high-speed steel. However, we have found, by an extended study of many fields, that the improved performance of such tools offsets their greater cost.

Cutting Qualities of an Alloy Steel as Influenced by its Heat-Treatment

By O. W. Boston and M. N. Landis

THE OBJECT of this paper is to present the results of a series of experiments made to determine the value of four methods of estimating a machinability rating by use of S.A.E. 6140 chrome-vanadium steel under various heat treatments. The cutting qualities are expressed in four ways: the cutting rating, drill torque, drill thrust, and drill penetration.

As it was desirable to have a steel available for machining, the procedure consisted of single and double slow-cooling treatments. The single treatments were for the purpose of obtaining an annealed steel, and the double treatments to obtain a spheroidized steel. It was assumed that the treatment giving the greatest divorcement of the pearlite into its constituents ferrite and cementite, spheroidizing, would give the best machinability.

The mechanical tests used in these experiments were confined to the cutting rating, the drill torque and thrust, drill penetration, and Brinell hardness number.

The cutting rating is expressed in per cent. This cutting rating depends on the shape of the chip produced by a turning tool (the amount of material cut, and the conditions of the cut surface), as observed under actual cutting conditions. The cutting speed was 150 ft. per

min., the depth of the cut was $\frac{1}{8}$ in., and the feed was 0.080 per rev. The test was made dry and cutting continued until the tool was destroyed. The cutting rating was based upon the judgment of the observer.

The drill torque is expressed in ft.-lb. and the thrust is expressed in lb. The values were obtained in these experiments by drilling the material on the end, that is, parallel to the axis of the bar. The drill used had a $\frac{3}{4}$-in. diameter and was made of high-speed steel. It was rotated at 152 r.p.m. and had a feed of 0.012 in. per rev. The drill was ground on a Blau drill grinder and had a clearance angle of 3 deg. 48 min., and a flute helix of 30 deg. All tests were conducted with the one grinding, and the drill appeared to be in very satisfactory condition at the end of the tests, as tests made at the beginning could be checked after all drilling tests were completed.

The drill press on which the torque and thrust values were determined was a short belt-driven Colburn No. 2 manufacturing-type drill with a 5-hp. motor mounted on the back of the column. On the table was mounted a specially designed dynamometer of the hydraulic type which would permit the torque and thrust to be registered automatically on a nearby Bristol recording gage. The torque values were also registered on a mercury column gage for check purposes, the scale of which was larger than that permitted on the Bristol gage chart.

The drill penetration for these experiments is expressed in minutes and is the time required for a $\frac{1}{4}$-in. standard high-speed steel twist drill, having a helix angle of 30 deg., a clearance angle of 4 deg. 42 min., to penetrate the material $\frac{1}{4}$ in. The drill was rotated at a speed of 504 r.p.m. under a dead load, including the weight of the spindle and drill, of 93.6 lb. A special drill press for this purpose was used. The $\frac{1}{4}$-in. depth of penetration was measured by using two beam-type indicators which were attached to a Vernier surface height gage, so that their points were exactly $\frac{1}{4}$ in. apart vertically. A stop watch was started when the first indicator read zero and stopped when the second indicator read zero. The lower edge of the drill sleeve was ground flat and smooth, and served as a reference surface.

All penetration tests were run with one drill grinding All materials were tested in turn once, and then tested in the same order the second and third times without regrinding the drill to note the influence of the dulling of the drill. It was desirable to make all tests with one drill grinding, as it was found almost impossible, in preliminary tests, to grind a small drill twice alike, even though a machine grinder was used. The dulling of the drill during the three sets of test was thought to be negligible, as the average of the three, or in some cases more, tests did not differ from the one most divergent by more than 3 per cent in any case.

It appears from the results that a pure annealing does not give the best machining qualities, but that, where the greatest divorcement of pearlite into its constituents, ferrite, and cementite, is obtained, that is when the steel is spheroidized, the machinability, as indicated by the chip rating and drill penetration, is highest. The drill torque, also, seems to increase as the machining qualities of the material are improved, while the drill thrust apparently has no relation to the machining qualities.

Surface Hardening of Special Steels With Ammonia Gas Under Pressure

By Raymond H. Hobrock

Engineering Experiment Station, Purdue University

IT IS the object of this paper to set forth the results of an examination into the relations existing between pressure of the gas (NH_3), hardness, penetration, and hardness gradient for one typical steel.

In this investigation the three fundamental variables in the treatment of the samples might be: (1) the temperature, (2) the time of treatment, (3) the pressure of the ammonia gas. However, the temperature at which the treatment is best effected has been examined into in previous works, and, for this experiment has been maintained constant at 875 deg. F. The time of treatment has been allowed to vary from 2 to 100 hours, and the pressure of the ammonia gas has varied from atmospheric pressure to 600 mm. of mercury above atmospheric pressure.

The alloy used in these experiments had a composition as indicated in the following limits:

Carbon,	Per Cent	0.38—0.43
Silicon		0.20—0.30
Manganese		0.40—0.60
Chromium		1.60—1.80
Aluminum		1.00—1.25
Molybdenum		0.15—0.25
Nickel		0.30—0.60

A general consideration of the results seems to indicate that the increase in pressure:

1. Does not greatly change the time required for reaching the maximum surface hardness.
2. Does tend to decrease the hardness at the surface if the treatment is continued for longer than about 25 hours.
3. Does considerably increase the depth of the case.
4. Does decrease the average hardness gradient.
5. Does permit the establishment of a high hardness at almost any depth depending on the pressure of the gas and the time of the treatment.

Theoretical Consideration of Results

From the results of these experiments, as well as the work of others, the following may be deduced:

1. An alloy intended for the establishment of a hard surface of no great depth might contain much more aluminum than an alloy intended for use where a deep case is required.
2. Where high surface hardness and deep penetration are to be obtained by nitration under pressure the amount of aluminum in solid solution in the alloy must be accurately controlled.
3. The increase in hardness due to the nitration of the alloy steels is due in part to the formation of a net work of crystals of iron nitrides, and in part to the formation of slip interference particles of aluminum (and other) nitrides.

Service Annealing of Sling and Crane Chains

By William J. Merten

Metallurgical Engineer with the Westinghouse Electric and Manufacturing Company

THIS paper discusses the inconsistent results, in ductility and strength, that are ordinarily obtained when chains are annealed at temperatures unsuited for links that have been severely deformed and cold-worked in service. The author recommends a uniform recrystallization at temperatures considerably above the transformation range to render the chain entirely safe for further service without resorting to a reduction of the safety load and basing the calculation of permissible stresses on the average cross sectional dimensions only.

An analysis of the results of the experimental and general evidence presented indicates that the factors involved in a complete reconditioning of a worn chain by reannealing are the following:

1. The degree of refinement of grain structure from the original heat-treatment of forge welded chain.
2. The degree of plastic deformation or cold work during service.
3. The degree of temperature above the Ac_3 point and rapidity of cooling from this temperature.
4. The duration of the heating at, and above, critical temperatures.

As a suggestion the following heat-treating practice for chains, is offered:

Heat uniformly to above the finish forging temperature (1,900 deg. F.). Hold for 1 hour per in. of cross section of largest part of chain (ring or hook). Then cool in air to black heat (700 deg. F.). Reheat uniformly to just above the Ac_3 point, hold for 1 hour; cool in air to approximately 1,000 deg. F., then slowly to room temperature.

Service Annealing

Heat chain uniformly to above the Ac_3 temperature for complete recrystallization. Hold for at least 1 hour at this temperature, and cool in air to a black heat of 700 to 800 deg. F.; then slowly to room temperature. The first part of this practice is not in general use and has been given little if any attention. Its performance probably contributes more to the life and performance of a chain than even the selection of the most suitable material. The complete success of the service annealing practice depends somewhat upon the attention given the chain during the first heat-treatment. If definite information regarding heat-treating practice after forming and forge-welding of chain is not at hand, a high temperature treatment for refining becomes imperative.

Progress Made in the Use of Electric Furnaces for Heat-Treating

By A. N. Otis

Industrial Heating and Welding Engineering Department, General Electric Co.

RAPID increase in the use of electric furnaces is shown by a list of 24 principal installations, the paper describing briefly some of the individual furnaces and their operation.

Probably the largest electric-furnace installation anywhere, is at the Fordson plant of the Ford Motor Company. There are 145 furnaces at this plant, used for a wide variety of work, such as heat-treatment and forming of spring leaves, heat-treatment of crankshafts, connecting rods, gears and other parts, and heating stock for forging. There are 115 furnaces in one building, the spring and upset department: 76 for heat-treating and forming springs; 28 for forging gear blanks and similar parts; 6 pusher furnaces for annealing, hardening and tempering; and 5 for tools, dies and small parts.

The furnaces for hardening and tempering springs are equipped with slot conveyors and are operated at about 1,500 and 875 deg. F. respectively. When removed from the hardening furnace, the leaves are clamped in a quenching fixture which forms and holds them to the desired shape.

The furnaces for heating the ends of the long spring leaves are arranged in pairs, a conveyor running between them so that both ends are heated simultaneously. The temperature is 2,000 deg. F. Emerging from the furnace, they are placed in a forming machine which curls both ends at one operation. In each of the units, leaves are heated and curled at the rate of 8 per min. The furnaces in this department are capable of handling 6,000 rear springs, 12,000 front springs, and 2,500 springs for the truck, in two eight-hour shifts.

The forging furnaces are a recent development. The absence of smoke, excessive heat and gases is a very desirable feature, which not only permits the furnaces to be located at the most advantageous points for the routing of the material, but also provides the best possible conditions for these employees, so that they can work at maximum efficiency.

The furnaces operate at 2,350 deg. F. and are automatically controlled, which insures against burnt or overheated forgings. About 700 lb. of forgings are produced per hour from each furnace, and the yield is about 4 lb. per kw.-hr. Such furnaces may be used extensively in the future for light forging work and other operations which require these temperatures.

The continuous annealing furnaces are of the four-track counterflow pusher-type, alternate rows moving in opposite directions.

There are nineteen furnaces of different types in the motors building. Three of these are continuous pusher furnaces, 24 ft. long, for hardening crankshafts. In order to save floor space the tempering furnaces are built on top of the hardening furnaces, with the entrance just above the discharge opening of the hardening furnaces.

They are of the chain-conveyor type, the finished work returning to the entrance end where it is unloaded. Each unit has an hourly capacity of 95 crankshafts.

Other furnaces in this building include: three pusher furnaces for hardening connecting rods; three pusher furnaces for tempering connecting rods; three pusher furnaces 42 ft. long for tempering gears; two rotary furnaces 14 ft. in diam. for hardening cam shafts; and two continuous furnaces for piston pins and push rods.

In the rolling mill there are two continuous furnaces for heating bar steel for forming ring gears, 300 and 400 kw. respectively, operating at 2,000 deg. F.; six forging furnaces, operating at 2,350 deg. F., and totaling 2,700 kw.; also three continuous hardening furnaces of 300 kw. each.

The number and diversity of applications in this plant alone, shows the adaptability of electric furnaces to many forms and purposes.

The fields of usefulness for oil, gas, and electricity, will vary with the conditions to be met, and with the locality. In the proper application of furnaces, each will be used where it will enable the maximum overall economy to be attained.

There is no doubt that the development of electric heating has been a valuable contribution to the manufacturing industries, as an aid to improving quality, reducing cost, in providing better working conditions, and enabling output per man to be increased. This art is relatively new, and appears to have vast possibilities for the future.

Methods of Approximating Certain Physical Characteristics of Nitrided Steel Cases

By G. M. Eaton

Molybdenum Corporation of America

THIS paper takes up the problem of finding out whether a nitrided product possesses the characteristics which justify the expectation that it will perform satisfactorily in a given service.

The file test fails completely to define the degree of hardness. Furthermore, it is utterly erratic because the first pass of any file we have been able to find, over a case with a hardness of say 700 to 800 Brinell, ruins the keen cutting edge of the file, so that it will refuse to cut a materially softer case on subsequent passes.

The ease and quickness of the scleroscope test makes it tempting, but the varying hardness of the nitriding case prohibits its use, as under the best conditions of set-up, it is entirely possible to secure the same reading on two cases of radically different surface hardness, and internal hardness gradation.

The hardest steel Brinell ball is far too soft for use with nitrided steel. The diamond ball offers some possibilities, particularly with very small balls, but here again the varying hardness is hostile. Unfortunately we were not successful, in the time available, in locating a Baby Brinell machine equipped with a diamond ball. A comparison of impressions showed an insufficient difference to permit distinguishing between a ductile and a brittle case when using a hard steel Baby Brinell ball. It is possible that a diamond ball would give more satisfactory results, although we doubt this. The Rockwell C diamond offers a better approach to the characteristics of the nitrided case although here again the varying hardness is inimical. Also, the stability of the diamond in this severe service remains to be proven.

It seems logical to believe that some of the recent diamond scratch instruments might offer a very good research tool for studying hardness penetration. This method, however, does not appear to lend itself to production work, as micro-polish is essential. The ability of the diamond to stand up properly for any length of time against the nitrided case remains to be proven.

The Herbert pendulum with a diamond ball probably offers the most accurate means now available for determining the hardness of the nitrided case. There are, however, very serious objections to its adoption for commercial work, as follows: The harder the case the more important it is that the surface be smooth, and micro polish is really necessary for good results; this instrument requires more skill on the part of the operator than it is customary to expect of men doing routine testing; with the Herbert pendulum we failed to detect an adequate distinction between brittle and ductile cases; we were not successful in devising a practical way of placing the instrument in accurately spaced locations for exploring the graduation of hardness of the case, and the failure of the instrument to give some measure of ductility is of itself sufficient reason for considering it impractical as a means for testing nitrided cases.

The Vickers Diamond Hardness Tester is in our judgment the best available instrument for demonstrating the fitness of the nitrided case for service. The tapering hardness is of course, objectionable, but we find the error to be outside the realm of practical importance, with the work we have done to date.

Pulling small wires, bending thin strips, pulling thin strips, and pulling thin tubes, for measuring ductility were all abandoned after extensive tests, in favor of the Vickers machine. When the time comes that it seems to be essential to evaluate the proportional limit, ultimate strength, and modulus of elasticity of the nitrided case, the thin-walled tubular tension test piece offers the best means that we have been able to devise to date.

Our service life tests have convinced us that it is essential to have a fairly definite plastic flow or ductility in the case, and that when the Vickers indentation spalls, the life of the product will be definitely inferior. Thus we have found a practical control test for nitrided products intended for wear-resistant service.

We are convinced that, unless some logical 100-percent test is applied to important nitrided products, there is a real chance of enough scattered failures occurring to unduly discredit the nitrided product. We further believe that in particularly vital heats good practice will call for the inclusion in the furnace of test pieces to be explored for hardness and penetration. When this is done, those responsible for production will have thoroughly reliable assurance of the quality of their product.

· TECHNICAL · ABSTRACTS ·

Research as the New Business Partner

Business is beginning to recognize the true value of the force called research. The services of this force have been employed spasmodically for many years, usually to meet some emergency. It is now realized that they will be of greater value if utilized regularly and consistently to the end that emergencies may be avoided.

Probably the main factor in retarding full recognition of this powerful business tool has been that it was not generally recognized as a separate force. When employed at all, it was usually linked with some other form of business activity and its identity concealed. As a matter of fact, research is a separate force, just as cost accounting and advertising are separate forces.

Forms of Research

The research method is applicable to any kind of business, and to any form of activity connected with the business. There are three forms known as "technical," "management," and "marketing." At the present time, with very few exceptions, the technical form only is used. To illustrate, a recent survey of several manufacturing concerns, each with a financial rating of $1,000,000 or more, disclosed the fact that approximately 60 per cent were applying technical research only. However, at the present time the press is full of articles on these different forms. In a group of articles analyzed, 58 per cent related to technical research matters, while the other 42 per cent were split rather evenly between management and marketing.

To be effective, research must be organized and systematic, continuous and persistent, separated from routine, daily work. To achieve its destiny in any business it must be given a real chance. It must have complete support from the executives, and it should not be expected to produce results overnight. The right man in charge of the work plus the full support of the management is a combination that will, in any business, inevitably bring worthwhile results. Research work is much like advertising in that it should never be started if the intention to persist is not well developed, and it is hardly worth-while to start it all if it isn't started right.

If a company is absolutely too small to afford research activities as a permanent part of the internal set up, it is necessary to employ outside agencies. However, every concern should have its own technical department, and its marketing department if it can at all afford them. They will be the laboratories into which ideas can be thrown for examination and refinement, and because research produces and cultivates foresight, these departments will generate and cultivate many ideas as well as the ones brought to them.—Ralph H. Dick, *Executives Service Bulletin*, September.

Cleaning Forged and Heat-Treated Articles

The cleaning problem of a heat-treating plant or forge shop resolves itself into a study of the product and daily tonnage to be cleaned; the amount of grinding to be done; the finish to be applied; the use to be made of the product by the consumer, and the selling price of the manufacturer.

For instance, pieces that come in contact with oil inside the machine should be blasted. Every particle of scale must be removed, otherwise it may loosen and cause serious damage. On the other hand, if a product does not require much grinding, and if in its use the loosening scale will not cause damage, then dry tumbling and water polishing will produce a finish suitable for rust-proofing, japanning or buffing.

Heat-treating, especially carburizing, leaves a scale on metal surfaces. On water quenched jobs, the scale is dry and brittle; on oil quenched work it is softer and more difficult to remove. Grinding scale always compels frequent redressing of the grinding wheel, which is costly in time used and in wear of the wheel. Sand blasting, on the other hand, reduces grinding costs from 20 to 50 per cent and permits a more attractive finish. For the sandblasting of twist drills, reamers, gears, gear blanks, edge tools, high-speed tools, and many types of drop forgings, the tilting sandblast mill has been found most satisfactory. It would seem that the tumbling action of this unit would cause damage or nicked edges, but due to the slow revolving motion, the pieces are not thrown violently, and for that reason are not damaged.

The primary advantages of sandblasting are as follows: the cost of cleaning is considerably reduced; all scale is removed from outside surfaces, as well as pockets, and checks or cracks are exposed; finishing is faster, and costs less; grinding costs are reduced in some cases as much as 50 per cent and the smooth, mat surface is ideal for japanning, enameling, or galvanizing, since the finish grips better, and less floor space is required to accommodate sandblast equipment compared to the space required for apparatus used to clean by means of tumbling or the use of chemical methods.

Tumbling mills are used quite extensively to clean forgings, such as wrenches, hammers, plow points, piston rings, and building hardware. In cases where a polish is desired, water polishing is used after the tumbling process removes the scale.—C. J. Stiers, *Heat Treating and Forging*, September.

Bangor & Aroostook Bonus System

In the early part of 1926, the Bangor & Aroostook Railroad inaugurated at its Derby, Me., shops a bonus system by which the workmen are guaranteed their hourly rate when they are unable to make the bonus price established for a job. The bonus system used is a modification of the Taylor and Emerson systems. The principal factors taken into account in the study are the former cost of operation, the cost figured from the time study, cost figured at a reduction of from 15 to 20 per cent of the former cost, based on possible short cuts and modernizing the operations, final assignment of man-hours allowed for the operation, and pro-rating the total bonus for an operation in proportion to the pay for the straight time worked where a standard operation is performed by a group working together.

Every device, such as hoists and cranes, that will increase production is put at the command of the men. The speeds and feeds of the machines are checked to see that each machine is in condition to give maximum production. It is the duty of the time-study supervisor and the shop foreman to see that no delays chargeable to the management are incurred while the work is being studied. When the bonus rates are set, the men are permitted to earn as much as they can. The amount of their pay check depends on their ability and resourcefulness in developing short cuts and labor- and time-saving devices. The rates are never cut unless the company purchases modern machine tools or more efficient tools.

Both the management and the men have benefited from this system. For example, an operation on locomotive boilers formerly required five men. When a bonus rate was assigned under the bonus system, the five men were reduced by the leader to two, with the exception that a third man is used but two days during the period instead of being continuously employed on the work.

The clerical work has been made as simple as possible. The men punch in on the clock when starting a job, and the bonus supervisor inspects the work at that time. If a man is called on another job before he has finished the first job, he punches out on the first bonus card. These cards are filed according to engine numbers so that, when an engine is completed, all the cards on that engine are filed away for future reference. When a bonus job is completed, the labor costs are prorated according to the number and occupation of the employees who did the work. The men are paid each week, while the bonus checks are made out separately from the regular pay checks.—*Railway Mechanical Engineer*, September.

IDEAS · FROM · PRACTICAL · MEN

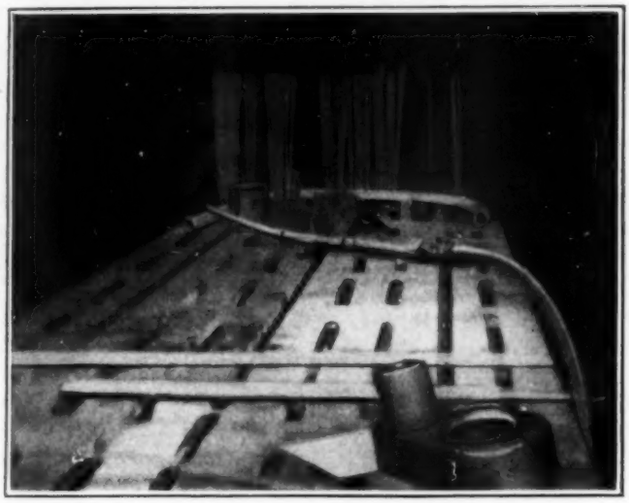
The department, "Ideas from Practical Men," is devoted to the exchange of information on methods useful to the machinery industries. Its scope includes all divisions of the metal-working industry, from drafting room to shipping platform. Descriptions of methods or devices that have proved their value are carefully considered, and those published are paid for. The rates are from a minimum of five dollars upwards, depending upon their merit

Bench for Welding

By Frank C. Hudson

In the shops of the Maine Central Railroad at Waterville, Me., is a welding bench made from the table of an old, discarded planer. The table is supported at a convenient height on a pair of horses and makes an excellent bench for the purpose.

A number of pieces of old boiler flues, tack welded to one end of the table, are used for holding welding rods of various sizes and kinds. In order to avoid both the waste and confusion of having odd pieces of welding rods scattered around on the table or floor, it is the practice to weld all short pieces together to approximately the length of standard welding rods. This practice has proved to be not only a real economy, but also to greatly improve the orderly appearance of the welding bench and to have the rods always available for the welder.



Welding bench having rod holders made from old flues

An Expanding Work-Holding Arbor for the Milling Machine—*Discussion*

By I. B. Rich

Referring to the article by Phil. Simoneau, under the title given above, published on page 68, Vol. 69, of the *American Machinist*, I agree with E. R. Plaisted in his discussion of that article, on page 511, Vol. 69, of the same journal.

A rubber band is hardly desirable for holding sections of a split bushing together. Still, it is surprising how long rubber bands will last. I have seen both coil and flat springs used for this purpose, the flat springs sometimes being made from old clock springs.

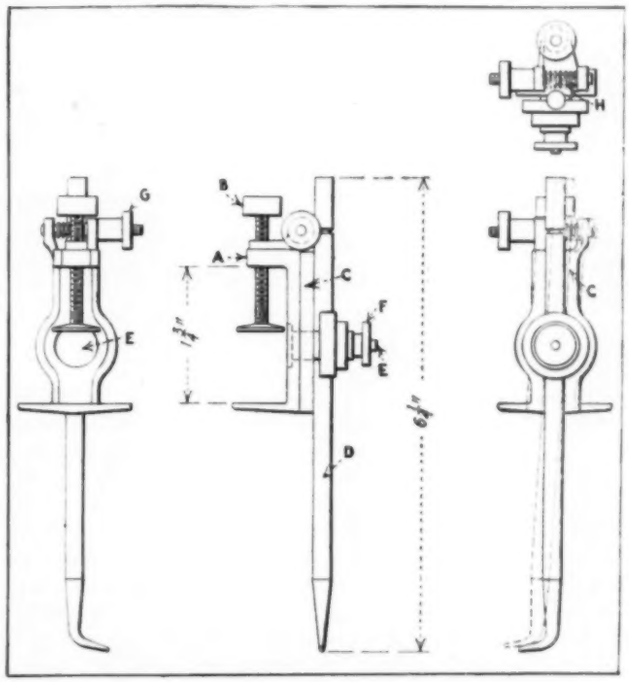
The split bushing described by Mr. Plaisted is good in many cases, and while, as he says, the slots are usually milled, I have seen them cut by a torch, being surprisingly narrow and having very smooth sides. The torch was attached to the overarm of an old milling machine and the expanding arbor to be slotted was fed under the torch by moving the table.

An Adjustable Trammel Point

By F. E. Clarke

Having a number of large fits to make on a vertical boring mill and not having calipers large enough, I began to look around to see what I could find to use to make the measurements. Not finding anything satisfactory in the market, I finally made an adjustable trammel as shown in the accompanying drawing.

Referring to the drawing: Body *A* is a bronze casting and is clamped with screw *B* to a wooden bar of sufficient length to cover the work in hand. Part *C* is also a bronze casting. This has a groove the whole length to receive the trammel point *D*, and swivels on stud *E*, both being held firmly by the tightening nut *F*. A very sensitive adjustment can be had by loosening slightly clamp nut *F* and then turning adjusting nut *G*



An adjustable trammel point

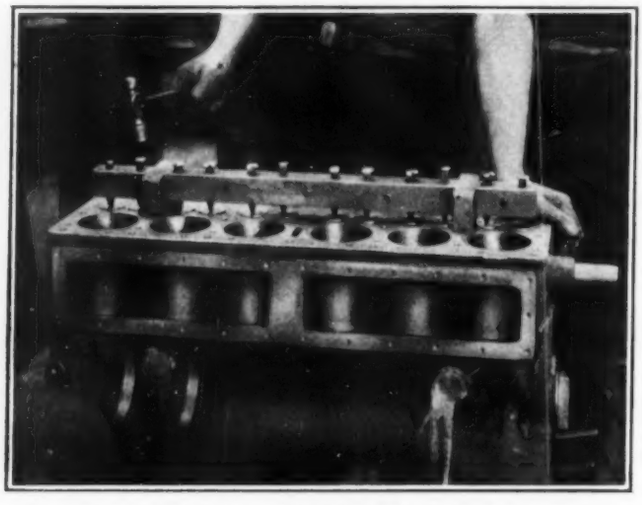
in either direction to get the correct setting of the points.

One of these adjustable trammels used with one of the regular solid ones works very well in any size work, simply by using a bar of suitable length. It can be used for inside or outside work simply by turning the points half way around. It is convenient to handle and takes up little space in the tool chest.

Numbering Engine Valves in Place

By Chester H. Franklin

For marking valves so that they can be easily assembled in their proper place after grinding, the Graham-Paige shop uses the stamping device shown. It consists of a frame composed of two flat bars, slotted to hold the square-shanked steel letter stamps, and fastened together with headless cap screws. Suitable feet are provided near each end to hold the device level, and in position.



Device for numbering valves in place

The stamps are numbered consecutively from 1 to 12, and the device is placed on the cylinder block so that No. 1 is at the front of the engine, and the stamps are over the valves. A light tap of the hammer on each stamp numbers the valves consecutively, so that there is no danger of their becoming mixed at any future time.

A Reminder for the Department Head
Discussion

By D. Becker

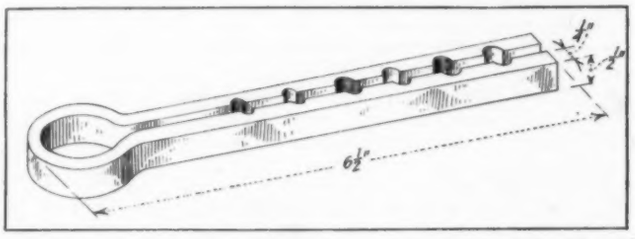
In the *American Machinist,* page 367, Vol. 69, there was an article entitled "A Reminder for the Department Head." The idea is good for a small department, but not so good for a large one because in the latter case the device would be too bulky.

The method used in the tool designing department of a factory in Dayton, Ohio, where there are about 100 designers, is more practical. Each man is furnished with a check with his number on it, and when he wants the foreman to see him he hangs his check on a board at the foreman's desk. This board has only 10 hooks, as it was found that there are never more than ten checks hung at one time.

A Useful Clamp for Machinists

By Edward Piranian

The sketch shows a clamp for holding small screws so that they can be held in the vise while cutting the threads or slotting the heads, without injury to either the heads or the threads. Small rivet blanks, also, can be held for forming the heads. The tapped holes are for the threaded parts of screws and the plain holes are for the rivet blanks.



Clamp for holding small screws and rivets

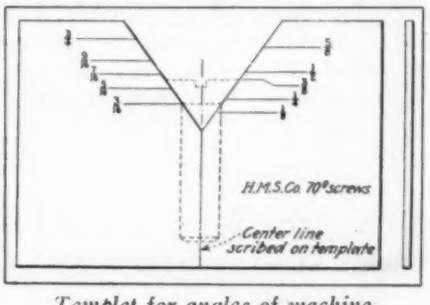
The clamp is made from ½x¼- flat steel, bent as shown in the sketch, leaving space for the easy insertion of the screws or rivets. Before drilling and tapping the holes, the legs are held together in a vise, a strip of $\frac{1}{32}$- steel being placed between them. After drilling and tapping the holes, the clamp is spring tempered so that the screws or rivets can be removed when the jaws of the vise are opened slightly. The time taken to make the device will soon be offset by that saved in doing the kind of work for which it is intended.

Templet for Drawing Angles of Machine-Screw Heads

By J. E. Fenno

The celluloid templet shown in the illustration is for use in drawing the angles of the heads of flat-head machine screws.

In the plant where I am employed, the screws range from $\frac{1}{8}$ to $\frac{1}{8}$ in. in diameter, and the included angle of the heads is 70 deg. The time required to lay out the angle has been greatly reduced by the use of the templet. It is necessary only to place the templet against the T-square, with its center line coinciding with that of the screw, and to locate the top of the head from the proper graduation. The angle of the head can then be drawn, leaving the lines for the top and the slot to be drawn by the use of the T-square and the triangle.



Templet for angles of machine-screw heads

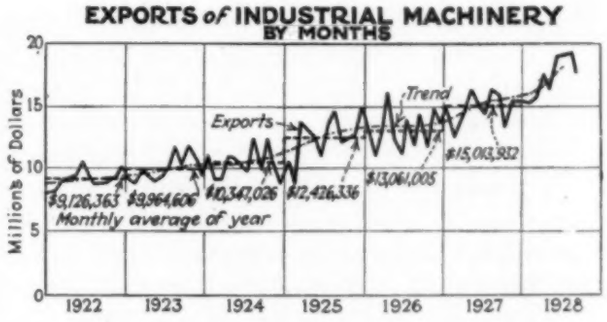
As shown, the templet is in position for drawing the head angle of a $\frac{1}{8}$-in. screw. The templet is graduated for the various sizes of screws, while the name of the screw manufacturer and the angle of the head are stamped at one side. Cuts on the under side at the top, provide ready means for lifting the templet from the drawing.

Activity in the Metal-Working Industry

Record Productive Operations in September

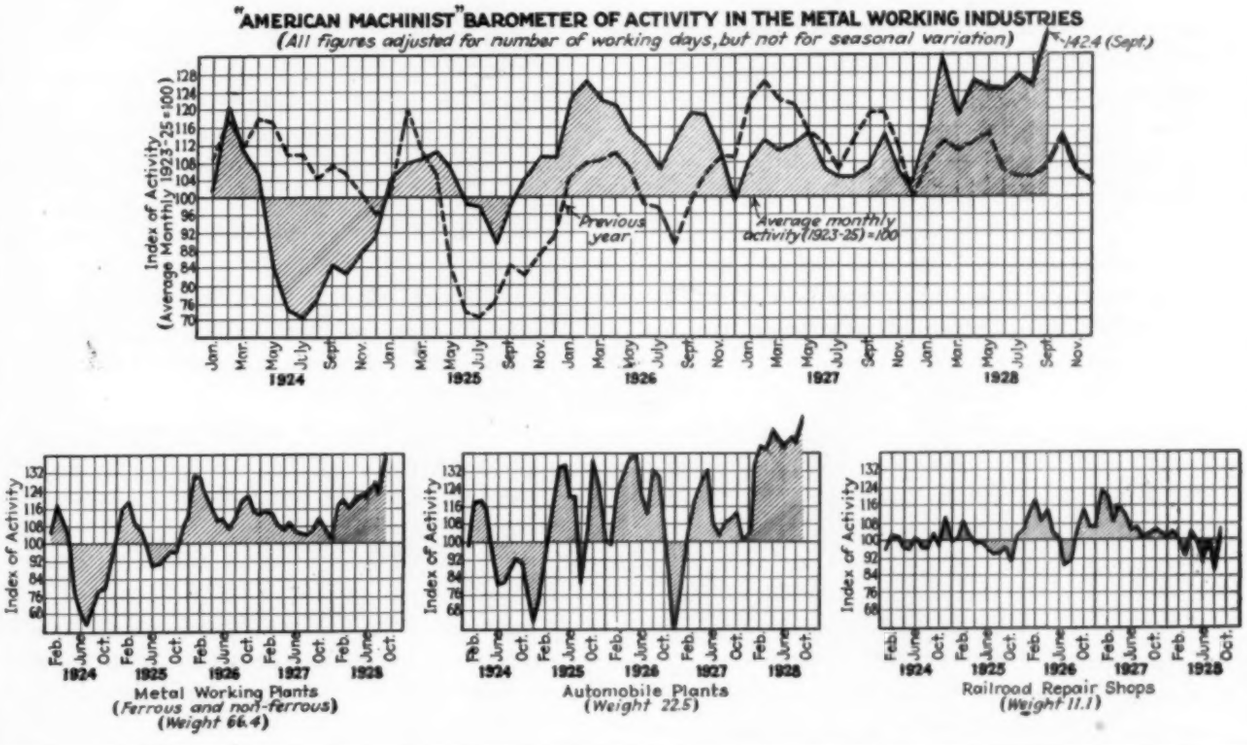
A new record in the rate of operations, as indicated by the monthly consumption of electrical energy, was made during September by the metal working industry. The September rate of operations, after correction is made for the number of working days in the month, was about 5.6 per cent above the former high figure established last February. During the month, the operations were increased by about 13.7 per cent over those reported for August, and were on a plane almost 34 per cent above September last year. It is normal for the rate of operations in the metal working industry to increase as the fall months develop, but the increase recorded during the current September was far in excess of that which would normally be expected. The upward trend in operations was general throughout the industry, very few plants reporting a lower consumption of electrical energy during September, although the month had three less working days than August.

The metal working plants reported an increase in the rate of operations of 14.2 per cent during September, bringing the index of operations in these plants to a point 36.4 per cent above those of September last year, and 12.4 per cent above the previous high mark established in February of this year. Last year the increase between the rate of operations in September and August was only 2.2 per cent, as against 14.2 per cent this year. The average rate of operations in these plants during the first nine months of the current year was 16.5 per cent over that during the same period last year.



Operation in the automobile manufacturing plants was also materially increased during September, being 10.2 per cent above August, 44 per cent above September last year, and 6 per cent above the previous high mark set in February and April of this year. The figures indicate activity in the production of repair and replacement parts, as well as in new cars.

Exports of industrial machinery showed a gain of nearly 9 per cent over the same month of 1927, but a decline compared with July, 1928. The exports for the first eight months of 1928 were 13 per cent above those of the same period last year.



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Examples of Good Management

RECENTLY two hundred men, attending the second national meeting of the Machine Shop Practice Division of the A.S.M.E., visited the Ashland, Ky., continuous sheet-rolling plant of the American Rolling Mill Company. The first thing they encountered, as they stepped off the boat that had been their means of transportation to Ashland, was an example of good management.

Fifty automobiles were in line, waiting to carry the visitors to the plant. Each driver was the owner of the machine in his charge, and was a man of responsibility in the Armco organization. He conducted his party of four to and through the plant. So far as the visitor could see, production went on just the same without fifty key men.

Of course these men are needed in the plant, or they would not be there. The impressive part of the whole thing is that they could as a body devote more than four hours to a group of visitors. It must be that good plant management is to be credited for the achievement.

Furnishing a guide for each four visitors is another example of good management, in this case not plant management, but management of an important, irregular problem. Having undertaken to show the visitors through the plant, it was necessary to give them the information they were there to get, and the one to four ratio was selected as the best answer as to how to do it. On the inspection trip in the average plant there are about twenty visitors to one guide, with the result that the guide's services are monopolized by three or four visitors and the remainder hang on the outskirts. Most of the men visiting the Ashland plant on this occasion had taken part in many plant visits and just because of that were thoroughly impressed by the one to four arrangement.

Many of the visitors were fortunate enough to be on the spot when a roll on one of the mills broke. Not only was a new roll in place within fifteen minutes, but during that time engineers had been at the roll and the machine to determine the cause of the break, had formed conclusions and had dispatched the data to everyone whose connection with the rolls makes the possession of such information necessary to prevent similar failures. It is, indeed, a serious matter when a mill producing two tons of finished sheets per minute is inoperative for a quarter of an hour.

Not all of the advantages of plant visits lie in seeing mechanical achievement. An understanding of the process in use at Ashland and a conception of the progress it represents were valuable acquisitions of the visiting engineers, but they did not exceed in value the lessons learned from the three examples of good management cited.

Reducing Spoilage by Proper Instruction

SPOILED work is one of the exasperating annoyances of manufacturing. It is likewise a total loss, and, according to some who have studied it, largely unnecessary. One authority states that from eight to ninety per cent of work spoilage can be traced to improper, or incomplete, instruction of the worker at some stage of his shop career.

If this statement is even half true, there is no question as to the advisability of carefully considering the problem of shop instruction. It is, in fact, not only advisable, but necessary to do so if we are to manufacture at still lower costs. The problem of proper instruction is, however, one involving so many factors that few men seem able to meet it with any marked degree of success.

In the old-time machine shop the owner himself, the foreman and most of the journeymen took a hand at teaching. The boy learned both from instructors and by observation. But increasing specialization, the growing need for high production methods, and keen competition imposed other duties on the various sources named. Special instructors were employed to teach the apprentices, and some concerns have maintained very efficient schools for the purpose. During the war the need for greater production brought forth special schools and training classes, not only for young apprentices but for mature men and women—some of them meeting with great success. With the post-war depression, however, most of these schools disappeared.

Assuming that the figures first quoted are even approximately correct, there seems to be little question as to the need for more and better instruction in most shops. Details as to methods, while essential, need not be discussed until management is convinced of the necessity of better instruction to reduce the waste due to unnecessary spoilage. When the economy of such instruction is fully appreciated, the ways and means will be forthcoming.

· SHOP · EQUIPMENT · NEWS ·

"Carboloy" Cutting Tools

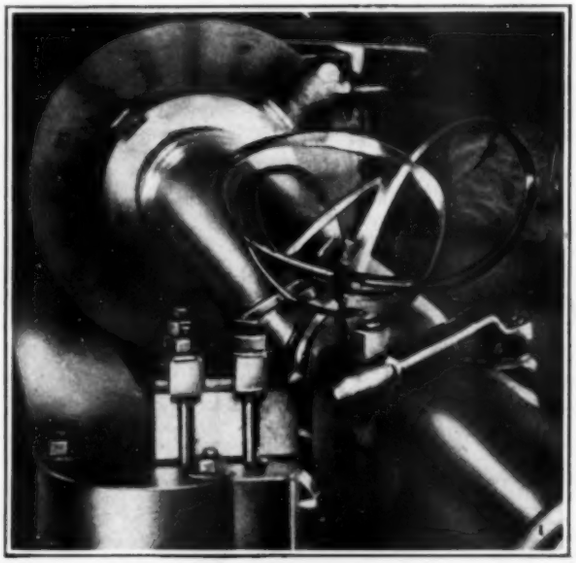
CUTTING a screw thread in a glass rod, machining porcelain on a lathe, and cutting the hardest of steels are among the things that can be done with "Carboloy" cutting tools, which have been developed by the Research Laboratory of the General Electric Company, Schenectady, N. Y. These tools have been placed on the market by the Carboloy Company, Inc., 350 Madison Ave., New York, N. Y. Carboloy is composed of tungsten carbide and cobalt, the carbide being extremely hard and the cobalt providing the necessary strength for cutting tools.

The results described in the following paragraphs are in accordance with reports of the General Electric tests. Hadfield's manganese steel, previously in the non-machinable class of metals, was found to yield easily to cutters made of this material. It has also been found that numerous experimental alloys can be machined. For example, even a block of hardened high-speed steel could be machined on a shaper, although with difficulty, and the same was true concerning super high-speed cobalt-chromium alloys. In experiments on molded materials containing metal inserts, such as fabric gears for automotive use, 11,000 parts were finished before the tools required resharpening.

A Carboloy tool, cutting nickel steel at the rate of 200 ft. per min., was run for an hour before the test was stopped; the tool was capable of cutting for a much longer period. In another run with a test log of chromium-nickel steel, with a cut of $\frac{3}{8}$ in. at 70 ft. per min. and a feed of $\frac{1}{8}$ in., a similar tool showed little wear after 10 minutes.

"Genelite," composed of copper, tin, and carbon, is so soft that it can be whittled easily with a knife, but it is also so abrasive that it dulls a steel tool almost at once. A cut on a small cylinder of only a few inches in length has always been tapered because of excessive tool wear. Here, again, the tungsten-carbide tools were not worn, and hence the cuts were not tapered. The bearing surfaces of commutators of electric motors, consisting of alternate layers of mica and copper were given a smooth finish without undue wear on the cutter.

One of the most difficult jobs with cast iron has been the removal of the surface layer. With tungsten carbide (Carboloy) the same speeds and feeds can generally be used for the surface as for the sub-surface cuts. Intermittent cuts are also made satisfactorily.



A "Carboloy" tool is shown cutting a nickel steel test log at the rate of 200 ft. per min. Note the very heavy cut

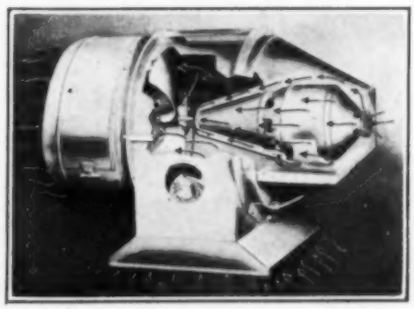
The hardness of Carboloy runs 2,000 and above, Brinell. It has a tensile strength of 275,000 lb. per square inch. If it is held against the side of an abrasive wheel, a deep, narrow groove is worn in the stone, without the Carboloy suffering much loss.

Carboloy does not pit or tarnish, and is dissolved in acids only with great difficulty. The moderate temperatures involved in cutting metals at the speeds generally used have not been observed to be harmful; but, if the speed is raised too high and the abrasion is severe, small particles of carbide may oxidize and shoot off from the edge as sparks. Ordinarily, the temperatures involved simply produce temper colors, much the same as they do with high-speed steel.

The material retains its strength and hardness at elevated temperatures. Tools have been observed cutting nickel steel when the point of the tool was at a bright red heat, without showing any ill effects. The material has no temper to be drawn by the heat generated, and it is much harder than the materials machined, even at elevated temperatures.

Paasche Explosion-proof Ventilating Unit

An explosion-proof ventilating unit for use with air finishing booths has been developed by the Paasche Airbrush Company, 1909-27 Diversey Parkway, Chicago, Ill. The unit supplies a strong circulation of air. The universal mounting and housing provide convenience in erection, and the unit is adjustable for four mounting positions, so that outlet connections can be made in the most convenient place. The motor is fully-inclosed, and is mounted on top, outside of the path of the fumes, saving space and affording safety. No paint fumes can touch the motor bearings, due to air space between them. The air passes through the screen shown in the illustration and over the motor. The cooling action prevents any possible explosion. The



Paasche Explosion-proof Ventilating Unit for paint spraying booths

specially-designed 3-blade aluminum fan handles a large volume of air per horsepower, and is easy to clean and remove without disassembling the unit.

This ventilating unit is made in four sizes, ¼, ½, 1 and 2 hp., giving respectively displacements in cubic feet of free air per min. of 2,700 to 3,200, 2,250 to 5,000, 8,000 to 10,000, and 14,000 to 16,000. The motors available operate on 220- and 440-volt, 2-phase circuits, 110- and 220-volt single-phase circuits, and 110- or 220-volt d.c. circuits.

Reliance Skeleton-Frame Induction Motors

Air is drawn through this skeleton-frame motor by an exhaust fan mounted on the end of the shaft away from the pulley. The motors have been placed on the market by the Reliance Electric & Engineering Company, Ivanhoe Road, Cleveland, Ohio. The cooling air is drawn into openings at the center of the back bearing bracket as shown in Fig. 1. The air passes over radiating bonnets and the stator, and is exhausted at the front end, as shown in Fig. 2. The large diameter fan builds up a high pressure, according to the manufacturer, and expels the air radially. The inner edge of the radiating bonnet is clamped tightly between the bearing housing and the inside bearing cap, thus making it a positive, stationary seal. A tight, stationary seal is made at the outer edge by fitting the bonnet into a machined surface in the stator frame.

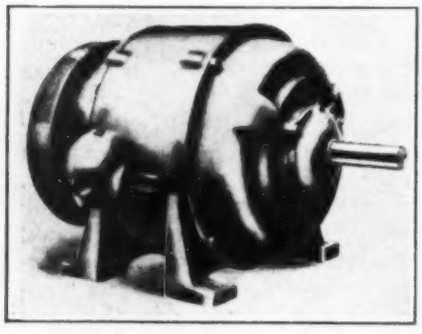


Fig. 1—Reliance Skeleton-Frame Induction Motor

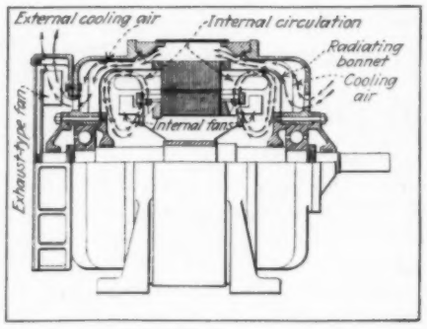
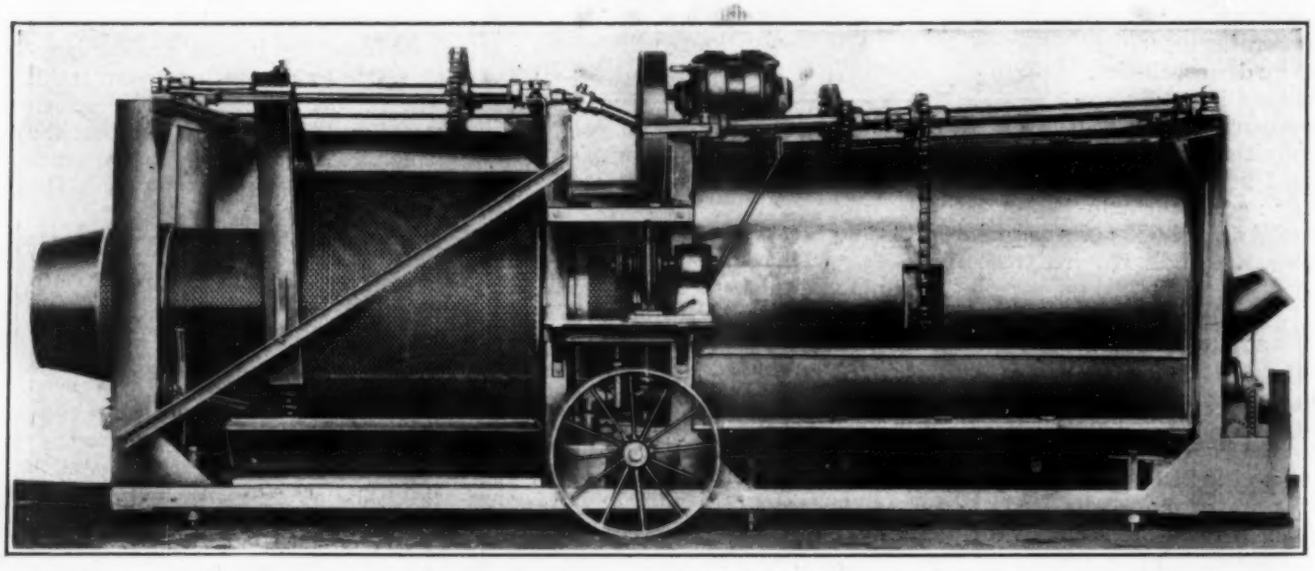


Fig. 2—Cross-sectional view of the skeleton-frame motor

Protection of motor windings from dust, dirt, and moisture is assured by the construction shown in Fig. 2. It will be noted that the air gaps between the stator and the rotor are protected from dirt and dust by the radiating bonnet. The ball bearings are also protected against dirt. The skeleton-frame motor is interchangeable in all mounting dimensions, but limiting dimensions exceed those of open-motor frame sizes, at the front end only by the amount necessary to allow for the external fan, which is inclosed by a substantial housing. Dirt from the cooling air drops to the bottom of the bearing bracket outside the inclosing bonnet, where it may easily be blown out by compressed air. The electrical and operating characteristics of this motor are the same as for those of an open motor. The sizes available range from 1½ to 40 hp. for operation on 220-, 440-, and 550-volt, 2- or 3-phase, 60-cycle circuits.

Ideal Tumbling Machine for Galvanized Forgings

Forgings are tumbled after hot galvanizing in this machine to shake off excess zinc. The machine has been developed recently by Ideal Industrial Machinery, Division of the Consolidated Concrete Machinery Corporation, of Winton Place, Cincinnati, Ohio. The charging end has a perforated end, which is hooded, and which rotates at about 50 r.p.m. The products are dumped directly into this screen and, as they pass through, are tumbled to shake off the excess zinc. From this screen, they pass into the secondary drum, which dips into a pan of water. In this secondary drum the forgings are quenched and then discharged into a wheelbarrow. It will be noted



Ideal Tumbling Machine for Galvanized Forgings

from the illustration that the machine is on wheels so that it can serve several galvanizing pots. Furthermore, the angle of the first screen is adjustable so that the speed at which the work passes through it can be regulated.

Jones Vacuum Lifting Devices

Metal sheets may be lifted with the aid of these vacuum devices so that lacerations to the fingers are avoided, or pieces may be fed to a punch press in such a manner that accidents are minimized. These devices, for which patents have been applied for, have been developed by Lewis Jones, Rayen & Foster Sts., Youngstown, Ohio. Fig. 1 shows the No. 2 vacuum lifter (the small device with the ring), which is used for lifting the edge of a metal sheet before grasping it with the fingers of the other hand. The lifter is worn on the middle finger at the back of the hand, between the first and second joints. It is 2 in. in diam., and is intended to be pressed down on the sheet for obtaining a grip. When releasing it, the cup is slid off the plate sideways to release the vacuum.

A larger size, No. 4, measuring 4 in. in diam., is provided with three finger loops and release valves. According to the inventor, a heavy sheet can be lifted and transferred by using one No. 4 lifter on each hand. Each No. 4 lifter is made with four hollow rubber valve stems. The valve is formed by cutting into the stem about half-way, with a sharp thin blade. To release the lifter, the valve stem is pressed with the fingers, thus permitting air to rush into the vacuum chamber.

The same principle is applied a little differently to the punch press feeder for light materials shown in Fig. 1 (the device with the bulb). The bulb is squeezed before the disk contacts with the plate or other object to be lifted. Upon releasing the palm pressure on the bulb, a vacuum is formed in the disk. The tubing is of brass and is screwed into the rubber disk, which contains a thread molded in it.

In Fig. 2 is shown a punch press feeder for large sheets and similar, heavy objects. In this case two vacuum disks are used and the space under them is exhausted by a hand pump or exhauster. The body is made of seamless steel tubing with one end closed by upsetting, and two ⅛-in. pipes are screwed in the end for connection with the disks. The piston is also made of seamless steel tubing and is provided with a movable sleeve that gives it support at the packing gland so that the piston itself can carry the bending moment created when lifting an object. A leather cup, similar to the one used in a bicycle pump, but inverted, is used as an air seal at the piston end. The disks are made of molded rubber, as in the device shown in Fig. 1, and a thread is molded in them so that the pipe can be screwed in place. Worn disks can be replaced readily by unscrewing them from the Y-forks.

In using this device, it is usual to suspend it from the Y-fork by means of a helical spring from the ceiling or other convenient point so that part of the weight load may be carried by the spring.

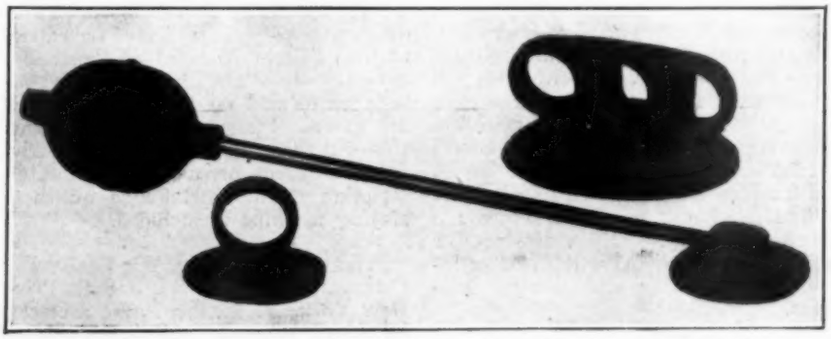


Fig. 1—Jones Vacuum Lifting Devices. The Nos. 2 and 4 sheet lifters are shown, together with a punch press feeder

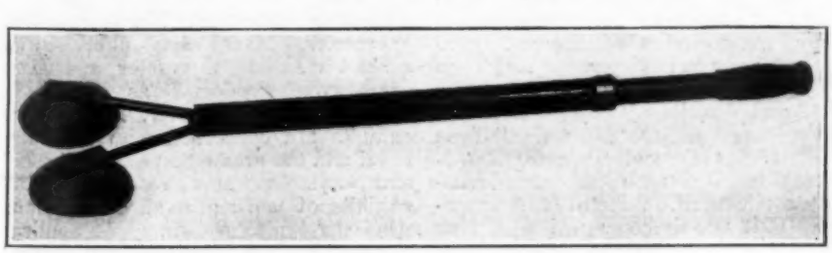


Fig. 2—Jones Punch Press Feeding Device of the pump type

"Lectrospray" Paint Spraying Gun

Sufficient air pressure is applied to the nozzle of this paint spraying gun to spray effectively any finish, including lacquers, paints, bronzes, and even whitewash. The apparatus has been developed by the Weil Lectrospray Company, Detroit, Mich. It consists of a paint spraying gun, together with a motor-compressor unit, which may be suspended from the shoulder by means of a strap or place on the floor. It is shown in Fig. 1. It is said that separating the motor-compressor unit from the spraying unit permits easier control of the spraying operation since there is no vibration of the nozzle.

Fig. 1—"Lectrospray" Paint Spraying Apparatus

In Fig. 2 is shown a cross-section of the paint spraying gun and the method of sucking the paint from the container. Through the use of a shut-off valve, the spraying operation is started with maximum pressure and

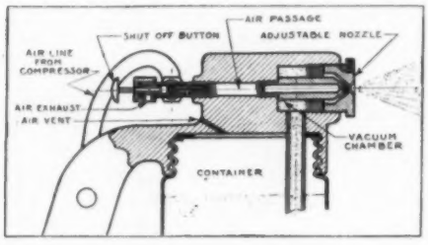


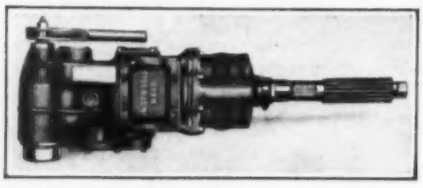
Fig. 2—Cross-section of the "Lectrospray" Paint Spraying Gun

can be stopped without stopping the motor-compressor unit. The nozzle may be adjusted to regulate the density of the spray from a light mist to as heavy an application as is desired. Because of its compact construction, the Lectrospray is convenient to handle.

Ingersoll-Rand Size 90 Air-Driven Close-Quarter Drill

A gear-driven close-quarter drill with a two-cylinder double-acting air motor has been developed by the Ingersoll-Rand Company, 11 Broadway, New York, N. Y. It is known as the size 90 close-quarter drill, and has been brought out for general drilling, reaming, and tapping in close quarters. The length of feed is 2½ in. Reamers and taps 2 in. in diam. and drills 3 in. in diam. may be used. The length of the device is 9¼ in. overall.

Minimum thickness of the machine has been secured by making it flat, the drill being practically the same thickness from the spindle to the cylinders. The distance from the side to the center of the spindle is 1 9/16 in. It can, therefore, be readily used in cramped places. Smooth operation at 140 r.p.m., secured by the air pressure of 90 lb. per sq.in., has been brought about by arranging the pistons to act at right angles to and in a plane with the spindle by using a counterbalanced crank and special gears for the drive. The gears are strongly built, their size and strength being increased as the load carried increases until the final drive on the spindle is through a heavy herringbone gear.



Ingersoll-Rand Size 90 Air-Driven Close-Quarter Drill

Anti-friction bearings of the ball and roller type are used throughout. Three different spindles can be furnished, the standard spindle having a No. 4 Morse taper socket. A threaded spindle 1 1/16 in. in diam., having 12 threads per in., can be furnished to take square socket chucks or the "Rich" chuck. The third spindle obtainable is a "Use-Em-Up" spindle which has a No. 4 Use-Em-Up taper. The hose connections are ½ in. The weight is 41 pounds.

Trade Catalogs

COMPRESSORS. The Chicago Pneumatic Tool Co., 6 East 44th St., N. Y., has issued a series of pamphlets devoted to air compressors and gas engines. Bulletin 700 shows a duplex air compressor, power-driven type. Bulletin 720 illustrates and describes air and gas compressors of the straight-line type, either steam or power-driven. Catalog 773 shows the "Giant" semi-Diesel oil engine, Class A-O-4. Bulletin 786 describes vertical duplex compressors, Type P6. Bulletin 787 shows portable compressors of the electric motor-driven type, and Bulletin 788 describes vertical simplex air compressors, Type P6.

CUTTING TOOLS AND ATTACHMENTS. The McCrosky Tool Corporation, Meadville, Pa., has published catalog No. 11 on cutting tools and attachments. Among those listed are: McCrosky-Super reamers, "Wizard" chucks, collets and tap holders; also turrets, steadyrests and faceplates for lathes. Each article is illustrated and views of setups are shown frequently. Tables of sizes for each style are included with the description. The catalog contains 63 9x6-pages.

GENERAL ELECTRIC PUBLICATIONS. The General Electric Co., Schenectady, N. Y., has issued three catalogs. Bulletin 71B supersedes 71A and describes wound-rotor induction motors, "900 series," Type MT (3-phase), and Type MQ (2-phase), Catalog 81B supersedes 81A, and describes high-torque double squirrel-cage motors, "900 series," Type FCR (3-phase) and Type FQR (2-phase) for constant-speed, continuous-duty applications. Bulletin 821A supersedes 821, and is concerned with type CR2927 pressure and vacuum switches of both a.c. and d.c. types.

"KINITE" ALLOY STEEL. The Kinite Corporation, Milwaukee, Wis., has issued Booklet No. 11, giving the characteristics, advantages, achievements, and instructions for use of "Kinite" cast-to-shape, air-hardening alloy steel. Many types of dies, gages, cams, and parts are illustrated. This material can also be welded by gas or electricity. The catalog contains 44 pages.

MATERIALS HANDLING EQUIPMENT. The Cleveland Electric Tramrail, Div. of the Cleveland Crane & Engineering Co., Wickliffe, Ohio, has published Catalog No. 4, entitled "Cleveland Hand and Electric Tramrail." The catalog is, in reality, a handsomely printed handbook bound in a tooled cover. It contains pictures of tramrail used in all sorts of installations in many industries. Many types of cranes, carriers, and hoists of both electric and hand types are illustrated and descriptions given. Hooks, scales, and, in fact, every device entering into a conveying system or loading device using tramrail in its construction are listed. The catalog contains several hundred pages.

NICKEL STEEL IN AIRCRAFT ENGINES. The International Nickel Co., 67 Wall St., New York, N. Y., has published a catalog entitled "Wasp and Hornet Aircraft Engines and their use of Nickel Steel." Photographs of various types of planes using these engines and also views of certain parts are given. The catalog also contains a list of airplane parts made from nickel steel, and describes both engines, and gives the power and fuel consumption for them.

PAPER BOX INFORMATION. The National Metal Edge Box Company, Philadelphia, Pa., has published a catalog entitled "Eight Minutes of Paper Box Information." The results of laboratory tests performed on metal edged boxes are given. Photographs are presented showing these boxes used for packing many different products. A short description of the metal-edge automatic staying machine is included.

PLIERS AND SHEARS. The Grobet File Corporation of America, 3 Park Place, New York, N. Y., has issued a catalog on pliers, nippers, and shears. Many types of these tools and their sizes are given. Each type is illustrated.

USES OF ABRASIVES. The Norton Co., Worcester, Mass., has published a booklet entitled "Character and Uses of Norton Products" as shown in Norton Hall, Worcester, Mass. The exhibits are concerned with raw material and the production of "Alundum" and "Crystolon" abrasives. Interesting exhibits of work ground with various wheels are also shown. The applications of Norton abrasives and refractories in building construction are given.

NEWS OF THE WEEK

Gear Manufacturers Discuss Processes and Standards at Buffalo Meeting

Joint session with Machine Shop Practice Division a feature

MANY broad phases of gear manufacture and related problems were discussed at the semi-annual meeting of the American Gear Manufacturers Association, held in Buffalo, October 11-13, at the Hotel Statler. About 125 members of the gear association were in attendance, together with about 50 members of the Machine Shop Practice Division of the American Society of Mechanical Engineers at the joint session on Friday evening, the 12th. Papers were presented on welding, nitration of steel, gear measurement, high-speed gearing, and on finishing gears by two processes.

Committee Reports

The meeting was called to order by A. F. Cooke, president of the association, on Thursday morning, after which a number of committee reports were presented. At later sessions other committees were heard from. All of the committee reports presented were in the nature of progress reports in that no standards or recommended practices were in such a stage of development that action could be taken upon them. J. C. McQuiston, Westinghouse Electric & Manufacturing Co., reported upon Publicity Committee progress; B. F. Waterman, Brown & Sharpe Manufacturing Co., outlined what work the various standardization committees were doing. In the report of the Spur Gear Committee, J. L. Williamson, research engineer of the Fellows Gear Shaper Co., chairman, a preliminary table of standard gears for selected conditions was presented by L. F. Burnham, mechanical engineer, R. D. Nuttall Co. The figures were based upon the tooth strength being equal to shaft strength, using the Lewis formula. An objection from the floor was to the effect that no recognition was taken of the tooth load of a gear for the most economical wear life. The committee is to develop the tables further for action at the annual meeting in the spring.

Other committee reports were: Keyway, by R. B. Zerfey, engineer, Tool Steel Gear & Pinion Co.; Metallurgical, by C. B. Hamilton, Jr., president, Hamilton Gear & Machine Co.; Research on Gears, by E. W. Miller, chief engineer, Fellows Gear Shaper Co.; Herringbone Gears, reported by Ira Short, Westinghouse Electric & Manufacturing Co., for A. A. Ross, chairman of the committee; Nomenclature, by D. T. Hamilton, advertising manager, Fellows Gear Shaper Co.; Tooth Form, by H. J. Eberhardt, secretary, the Newark Gear Cutting Machine Co.; Worm Gear, by W. H. Hines, Westinghouse Electric & Manufacturing Co.; Non-Metallic Gearing, by T. C. Roantree, Micarta engineer, Westinghouse Electric & Manufacturing Co.; Inspection, by L. C. Buehler, secretary, Indianapolis Tool & Manufacturing Co.; Sprocket, by G. M. Bartlett, consulting engineer, Diamond Chain & Manufacturing Co.; Differential Transmission, by S. O. White, chief engineer, the Warner Gear Co.; and Library Committee, by E. G. Noble, chief engineer, the Horsburgh & Scott Company.

The committee on Nomenclature proposed that the term normal pitch as applied to spur gears should be changed to base pitch, defined as the distance measured along the line of action between two successive involute tooth surfaces. Backlash was defined as the shortest distance between non-driving surfaces of mating gears. The committee promised through its chairman to have spur, bevel and helical gear nomenclature ready by the next meeting.

Paper on Welding

At the Thursday afternoon session, J. F. Lincoln, vice-president and general manager of the Lincoln Electric Co., presented an address on "The Effect of Arc Welding on Manufacturing," in which he showed how some typical cast-iron machine parts were replaced with welded structural shapes at lower cost and greater strength. A lively discussion followed participated in by B. F. Waterman, E. W. Miller, C. B. Hamilton, W. H. Hines, and others, in which Mr. Lincoln was challenged to apply welding methods to certain machine tool designs. One engineer of the General Electric Co. went so far as to predict that in ten years there would be no foundries in his company. Mr. Hines, of the Westinghouse company, cited an example of the production of a gear case by welding, in which the cost proved much greater than for a cast-iron member.

At the evening session on Thursday, Major Theron M. Ripley, assistant county (Erie) engineer in charge of road development and general traffic, pointed out to the delegates the future possibilities of Buffalo, the "International City." On Friday morning, Russel M. Coldwell, the Fellows Gear Shaper Co., presented an illustrated talk on "Predetermining Quality Gearing," in which he brought out some of the methods of detecting gear faults. After explaining some of the methods used for elemental measurements, he went on to explain the principles of operation of "The Red Liner," an error integrating machine developed by his company to chart the variation in center distance caused by the gear being tested being rotated in contact with a master gear, held against the former by spring pressure while mounted on a pivoted bracket. The line drawn by a pen actuated by the movement of the master gear and held in contact with a roll of paper indicates variations in tooth thickness, eccentricity and angular velocity, and because of the recording feature, it is possible to compare the gear before and after heat-treatment to measure the distortion, if any.

Covert Tenders Luncheon

In a paper on "Nitration of Steel," W. H. Phillips of the Molybdenum Corporation of America, pointed out what progress had been made in hardening of certain alloy steels by exposure to ammonia gas. Immediately after this presentation, the entire group was entertained at luncheon as the guests of A. A. Gloetzner, president and general manager, the Covert Gear & Manufacturing Corporation. In the afternoon, inspection trips were made to the Lumen Bronze Co. of America and the Farrel-Birmingham Company.

At the joint session in the evening with the Machine Shop Practice Division of the A.S.M.E., L. C. Morrow, chairman of the division, introduced E. W. Miller, chief engineer of the Fellows Gear Shaper Co., as the chairman of the meeting. Because of his familiarity both with the subject matter of the papers and with the members of the gear association, Mr. Miller was able to draw out considerable discussion on both papers. The first was by Ira Short, marine engineer, Westinghouse Electric & Manufacturing Co., and was entitled "High-Speed Gearing." In it Mr. Short brought out some of the requirements of high-speed turbine gearing for both marine and stationary work and how they are met with in practice. For example, with wide-face helical gears it is necessary to provide a floating pinion mounting to assure alignment of the teeth. The gears must be cut with the greatest possible accuracy and for this reason, the Westinghouse company has developed its own hobbing machines for this work. The master element of the machine is the table indexing worm-wheel, which is split in half at the throat with the two halves lapped with a cast-

iron worm in various positions relative to one another until no overlap is indicated in any relative position. An interesting device for analyzing gear noise was shown in a resonator by means of which the period of vibration could be measured and the sound traced to its source. Mr. Short also indicated that with correct alignment and well-lubricated teeth, the life of such gears was indefinite.

The other paper was presented by H. D. Tanner, manager of the gear division of the Pratt & Whitney Co., on the Barnes Gear Shaving Process, in which he analyzed the principles of operation and construction of the Barnes machine being built by the Pratt & Whitney Co. An abstract of this paper is to appear in an early issue of the *American Machinist*. Among those who discussed the two papers were: Mr. Fish, chief engineer of the Brown-Lipe-Chapin Co.; Mr. Turbovitch, Detroit-Timken Axle Co.; H. J. Eberhardt, and L. F. Burnham. In the discussion, Mr. Short indicated that a 20-deg. helix angle is now used instead of a 30-deg. to give integral contact, or two teeth in contact at all time, instead of 2½ to 3, thus giving a constant tooth deflection and eliminating one source of gear noise. Although a heavy oil was found to deaden noise, for efficiency reasons an oil of 350 sec. Saybold was used.

At the Saturday morning session H. J. Willis, research engineer of the Carborundum Co., presented a paper on "The Manufactured Abrasives in Gear Lapping."

Steel Treaters Exposition Attracts Large Attendance at Philadelphia

Zay Jeffries named to head A.S.S.T. for coming year

NATIONAL metal week opened in Philadelphia on Monday, October 8, with the Tenth Annual National Metal Exposition in conjunction with the Tenth Annual Convention of the A.S.S.T., the Fall Meeting of the Institute of Metals, and the Fall Meeting of the American Welding Society. More than 80,000 sq.ft. of space in the Commercial Museum was occupied by the booths of 350 exhibitors. Oil, gas, and electric furnaces, set up to approximate actual operating conditions, constituted one of the important divisions of the exposition. The featuring of metals included the newer corrosion-resistant and heat-resistant alloys, tool steels and special steels of all kinds, non-ferrous metals, and the new cutting alloy "Carboloy." Welding equipment was extensively featured, and also various testing equipment for laboratory and shop.

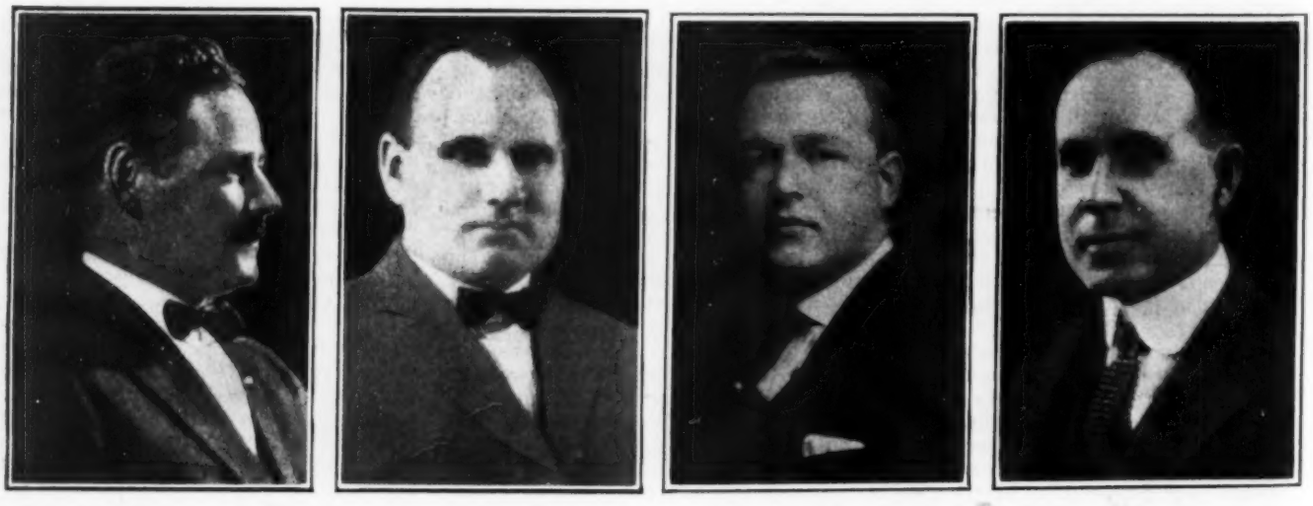
At the annual meeting of the American Society for Steel Treating, held on Wednesday morning at the Benjamin Franklin Hotel, Zay Jeffries was nominated president of the Society for the coming year. Dr. Jeffries has been vice-president of the Society during the past year, and has completed five years of executive work for the organization, having been treasurer for the four preceding years. He is a consulting metallurgist, and has been connected with the metal-working and metallurgical industries for many years. Dr. Jeffries was born in South Dakota on April 22, 1888. He was graduated from the South Dakota School of Mines in 1910, and in 1918 he received the degree of doctor of science from Harvard University.

Other officers nominated for the coming year are R. G. Guthrie, chief metallurgist, Peoples Gas Light & Coke Co., Chicago, vice-president; W. H. Eisenman, secretary; and J. M. Watson, treasurer. The new directors designated are F. T. Sisco, chief of the metallurgical laboratory, United States Air Corps, War Department; and A. H. d'Arcambal, metallurgist, Pratt & Whitney Co., Hartford, Conn. Election will be by mail ballot this fall, the new officers to assume their duties in January.

Monday morning was largely taken up with the registration of members of the A.S.S.T. and the A.W.S. The business of the session got under way, however, with the opening technical session of the A.S.S.T. at 10 a.m. at the Benjamin Franklin Hotel. The exposition opened its doors at noon on Monday. The morning technical session was presided over by R. M. Bird, of the Midvale Co., New York, and past president of the A.S.S.T. The papers were devoted to the discussion of corrosion-resistant alloys. At the afternoon session on Monday A. E. White acted as chairman. The full programs for the activities of the three organizations during the week were published in the October 11 issue of the *American Machinist*, and abstracts of a number of the papers presented appear in this issue.

More than 400 executives, engineers, and metallurgists attended the morning sessions of the A.S.S.T. on Tuesday. It was reported that numerous visitors from abroad attended the exposition and sessions, especially engineers from Germany.

On Monday the Chamber of Commerce of the city of Philadelphia tendered a luncheon to the delegates, at which Mayor Mackey greeted them in the name of the city. In response to the Mayor's welcome, Frederick G. Hughes, president of the Society spoke of the development of the A.S.S.T. within a few years, and said that "the keystone of the organization is that of bringing practical steel workers and scientists into close contact for the benefit of the industry as a whole." Mayor



Officers nominated by the American Society for Steel Treating for the coming year

Reading from left to right: Secretary, W. H. Eisenman; president, Dr. Zay Jeffries, consulting metallurgist; vice-president, R. G. Guthrie, chief metallurgist, Peoples Gas Light & Coke Co., Chicago; and treasurer, J. M. Watson

Mackey also welcomed the members of the American Welding Society at its opening session on Tuesday, at which more than 100 members attended.

Aviation was the feature of the annual A.S.S.T. banquet, Thursday night. Charles E. Carpenter, president of E. H. Houghton & Co. served as toastmaster. The principal speaker was E. P. Warner, assistant secretary of the Navy in charge of aeronautics. The speaker traced the history of aviation and its connection with the progress of steel and metallurgy. The earliest airplanes were about 98 per cent wood, outside of the motor and the fabric covering the fuselage. Today, the 98 per cent is mostly metal. At first, the metal used was pure aluminum. Although alloys have been developed which are far superior to pure aluminum, there is still a wide field for experiment. Of course the present volume of metal used in aviation does not, in itself, justify heavy research programs. However, the speaker stated, the materials developed in such research would find extensive use in other industries. The steel men owe it to themselves, and to their country, to go ahead with the program.

Robert M. Bird presented the past-president's medal to J. Frederick Harper, member of the board of directors and past president of the A.S.S.T., for special services to the organization. The Henry Marion Howe medal, in memory of Professor Howe, a pioneer in metallurgy, was presented to Oscar E. Harder and R. L. Dowdell for the best technical paper of the past year. This is the first time this medal has been presented to men connected with an educational institution. Mr. Harder is professor of metallography, and Mr. Dowdell assistant professor of metallography, in the University of Minnesota.

Equipment Sales

The sales of machinery and equipment from the floor during the week were reported by the management to be approximately as follows:—Monday, $200,000; Tuesday, $800,000; Wednesday, $1,120,000; and Thursday and Friday, $1,250,000 each. About 6,000 registered at the various headquarters, and 63,000 visitors attended the exposition.

Many ladies accompanied their husbands to Philadelphia for the week of the exposition and conventions, and more than 125 had registered on Monday and Tuesday for the entertainment features arranged for their benefit.

Inspection trips for the members of the A.S.S.T. were arranged for the Leeds and Northrup Co., Temple University laboratories, Westinghouse Electric & Manufacturing Co., Brown Instrument Co., Victor Talking Machine Co., Autocar Co., Tinius Olsen Testing Machine Co., and the U. S. Navy Yard. An inspection trip to the Naval Aircraft Factory at League Island was arranged on Wednesday afternoon for the members of the American Welding Society.

Announcement has been made that Cleveland will be host to National Metal Week in 1929. The American Society for Steel Treating has contracted for the use of the Public Auditorium of that city from Sept. 9-13 for its eleventh annual convention and National Metal exposition. The exhibition will occupy the arena floor of the auditorium and the entire annex. The annex, a spacious, modern exhibit hall, has been built since the society held its convention in Cleveland in 1925.

It is regarded likely that the American Welding Society and the Institute of Metals division of the American Institute of Mining and Metallurgical Engineers again will co-operate by holding meetings simultaneously.

Additional Exhibitors

Below are given the names of exhibitors and their products not appearing in the list published in the Oct. 4 issue of the *American Machinist*. These names did not appear in the original list due to late arrival at the show.

Adamant Fire Brick Co. Refractories.

Ajax Electrothermic Corporation. High-frequency induction furnaces, salt bath furnaces.

American Gas Association. Latest developments of gas-fired heat-treating furnaces.

American Steel & Wire Co. Welding wire.

American Welding Society. Welded products.

Atlas Steel Co. Dies, punches and steel parts made of its steels.

Automatic Nut-Thread Corporation. Nut making and tapping machine.

Bausch & Lomb Optical Co. Metallographic equipment, screw thread contour measuring device, and toolmaker's microscope.

Bilgram Machine Works, Inc. Gears and gear-cutting machines.

Bristol Co. Automatic temperature control instruments.

Brown & Co., D. P. "Sprucolite" pulleys.

Brown Instrument Co. Pyrometer control instruments.

Brown Lynch Scott Co. Machines for cleaning and grading carburizing compounds.

Budd Manufacturing Co., E. G. Pressed steel automobile parts.

Carboloy Co., Inc. "Carboloy" cutting tools.

Carpenter Steel Co. Five grades of stainless steels.

Case Hardening Service Co. Furnaces and carburizing compounds.

De Walt Products Co. "Wonder Worker" saw, bandsaw, and mortiser.

Duriron Co. Steam jets, acid-resisting equipment.

Eastman Kodak Co. Exhibits of radiography of metals.

Electric Arc Cutting & Welding Co. "Alternarc" and "Dualarc" welding sets, accessories.

Elkon, Inc. Welding points for welding machines.

Federal Welder & Machine Co. Several general and special-purpose welding machines.

Frew Machine Co. Single-spindle tapper, hand miller and motor-driven saw bench.

Fusion Welding Corporation. Welding sets and accessories, and a stainless steel annealing pot.

Gehnrich Indirect Heat Oven Co. Indirect heat-treating furnaces.

General Electric Co. Automatic welding machines, atomic-hydrogen welding machine, babbit melting pot, and samples of atomic hydrogen welding and copper brazing.

Globar Corporation. "Globar" resistor units for heat-treating furnaces.

Gray Iron Institute. Examples of gray iron casting work.

Hartford Machine Screw Co. Many types of screws.

Hayes, C. I., Industrial furnace engineers. Industrial electric furnaces.

Heintz Manufacturing Co. Automobile stampings, and welded steel assemblies.

Illinois Steel Co. Automobile stampings.

Jones Machine Tool Works. Six-in. vertical shaper.

Keller Mechanical Engineering Co. "Kellocater" jig borer, automatic tool room machine, and "Kellerflex" machines.

Kinite Corporation. Examples of cast-to-shape dies and other parts made of "Kinite" alloy.

Lavino & Co., E. J. Chrome refractories.

Leitz, Inc., E. Metallographic equipment, grinding machines.

Linde Air Products Co. "Carbide" generators and lighting equipment, tanks and welding torches.

Marburg Bros., Inc. Thiel precision die filing and sawing machines.

Midvale Co. Extra high-speed steel cutter blades.

Milburn Co., Alex. Torches and cutting accessories.

Millbury Steel Foundry Co. Alloy steel castings, particularly of tungsten and stainless steels.

Molybdenum Corporation of America. Various types of nitrided steels.

Morris, Wheeler & Co. Welding wire and accessories.

National Electric Light Association. Display of heat-treated steels illustrating possibilities of electrical methods.

New Departure Manufacturing Co. Ball bearings.

North Wales Machine Co., Inc. Gray-iron machine-molded castings, power-driven hacksaw, grinding machines, and milling machine vises.

Norton Co. Refractories and abrasives.

Nukem Products Co. "Basolit" pickling tank lining compound, and mechanically-driven pickling tank.

Nuttall Co., R. D. Gears and speed reducers.

Owen Electric Manufacturing Co. Welding wire, accessories and an a.c. induction arc welder.

Page Steel & Wire Co. Welding wire, cable and pictorial displays.

Red-E-Data, Inc. Data books.

Riehle Bros. Testing Machine Co. Vickers hardness tester, universal testing machine, and others.

Rodman Chemical Co. Carburizing compounds.

Shenango-Penn Mold Co. Centrifugally-cast bronze pipe.

Siewek Tool & Die Co. Drill jigs and die sets.

Steel Castings Development Bureau. Castings from 3 oz. to 5,500 lb. shown as examples of developments in technique made for the eight member steel foundries scattered over the Eastern area.

Steel Publications Inc. Magazines.

Sullivan Machinery Co. Gas-engine-driven air compressor with automatic control equipment.

Timken Steel & Tube Co. Pictorial exhibit of products.

Thomas Co., R. D. Gibb Welding Machine Co. welding presses in seamer, press and spot welder types.

Trust Oil Co. Special lubricating oils and cutting oils and compounds.

Unishbar Co. Hand and power types of shearing devices.

U. S. Naval Aircraft Factory. Engine exhibit comprising Laurence, Ballot, Packard, Gnome, Wright Pratt & Whitney, and other types.

Wickwire Spencer Steel Co. Welding wire, testing machines, high-temperature-resistant wire conveyor belt.

Willson Goggles, Inc. Goggles and handshields.

Ziv Steel & Wire Co. Dies, forgings and tool steel.

Actual demonstrations were carried on in many of the booths.

French Machinery Trades Concerned Chiefly With Equipment

American exporters may look to strong German competition

By Our Paris Correspondent

THE machinery industry in France has entered into a new phase since the War by the constant increase and improvement in manufacturing equipment. It is generally believed, however, that the end has not been reached, and that the turn of plants of moderate and small size is yet to come. This means an extended sale of modern machinery such as never before been known in France.

Allied with the possibility of such a line of business shaping up in the near future is that of extended credits. Distributors of tools and machinery are all in accord on this point, but in most cases the strain of the load can not be carried by them alone.

The suggestion has been made that the American manufacturer, looking to the increase of his business in France, should help carry this load either directly or by financial co-operation. Most machinery and tool distributors, and importers in particular, are finding limitations to their efforts in opening up new French outlets for American machinery, which German makers are making strenuous efforts to capture.

One Form of German Competition

The German machine tool manufacturers' syndicate is understood to be on the point of opening a Paris office to handle the increasing volume of business resulting from the payment-in-kind clause of the reparations agreement. This seemingly open form of competition in the French market benefits only one country—Germany. Others selling competitive as well as French manufacturers themselves, are now feeling the real effects of this in many lines.

It is rumored that certain French automobile manufacturers have found in the above arrangement a source of supply for new plant equipment on exceedingly long credit terms. American manufacturers must recognize that here is a hurdle which will have to be surmounted in some manner. It should be further noted that all payments in kind from Germany directly required for "works of a general utility," which includes railroads, enter France duty free in accordance with the law of March 24, 1928.

Actually the French situation in the metal working industry is favorable in many aspects. Given the notable growth which all have had in Europe since the war, the reflex on France is highly visible. From 1914 when France occupied fifth place in metallurgical exports, the country has now advanced to first in tonnage from 500,000 to 5,250,000. The preponderance taken by France in so many export lines is only an indication that one day or another the home market will undergo development and increase the demand for the output of the metal working industries. Only interior economic conditions appear to have prevented this to date. An example as showing certain phases of the trend of trade conditions may be cited. A big wire and cable manufacturing concern has booked an important order for the British Post Office against British competition based on price and quality. There are reported demands for automatic polishing and grinding machinery, stamping presses, time clocks, belt and other conveyor systems, wood shredding and granulating machinery and oil burner appliances for industrial uses. One maker records important orders in hand for hydraulic machinery for abroad to the value of several million francs.

Status of Automotive Industry

Monsieur Citroen, speaking before the general assembly of the Automobile Constructors Syndicate said, "Three facts dominate the automobile industry in France. They are: (1) Production should be intensified so that we may make progress in foreign markets; (2) Taxes affecting the production and usage of automobiles in France should be reduced, and (3) Tariff stabilization should be arrived at forthwith."

Franco-Italian trade relations have shown some curious fluctuations during the past two years. In 1926, during the first six months, French automobiles were exported to Italy to the value of 65,053,000 francs while in the same period in 1927 this fell to 14,428,000 francs and in 1928 to 13,000,000. The ascendency of the Fiat car as well as other Italian makes, due to reductions in price brought about by improved production methods is undoubtedly the reason for the above. French power machinery exported to Italy during the same period in 1927 was valued at 31,370,000 francs and in 1928 but 24,000,000 francs. Machinery parts, including automobile parts, stood at 38,364,000 francs in 1927 and 27,680,000 in 1928.

French export and import figures have not changed their proportions greatly during the past few months. Imports for the last seven months from Germany have increased, but have fallen off from the United States and Great Britain, in the former case to the value of 600,000,000 francs. Exports likewise fell in value, in the case of Great Britain being more than 1,250,000,000 francs. The drop in exports to the United States amounted to 200,000,000 francs. The total imports for the last eight months decreased 244,987,000 francs and exports decreased (which is more serious) 2,217,167,000 francs.

Actually the last three months have seen an increase in imports over the averages of the first three months of the year, explained by the customs authorities as being due to shipments of raw materials and other items upon the assurance that the franc was stabilized. The commercial balance is decidedly against France, but it is believed that the situation will improve by the end of the year. In spite of these figures manufactured articles on the import list increased 1,141,418,000 francs, and the same classification in exports decreased 526,420,000 francs.

There is an important development in the import of tool steel into France. During the first six months of the present year these imports exceeded a thousand metric tons, whereas during the entire year of 1927 the import figures showed only 280 tons. Exports show a smaller amount, but still notable. The obvious conclusion is that French production is not equal to home demand and that the wide distribution of high-output machinery is making more call for tool steel than was known previously.

The French Bureau of Normalization, which is working in close co-operation with similar organizations in Belgium and Italy, has just published its specification of "normes" for automobile pipe joints, magneto dimensions and lantern supports. The secretary calls the attention especially of all machine constructors to the value and significance of the word "norme" and the necessity of causing specifications calling for such to use the officially recognized number, as in the case of wire and sheet gages, and not merely by using the word "standard."

The most recent items up for normalization are those of fixed and moveable tool handles and the definite specification of tool steels in rounds, hexagons, and squares. Next on the list is to be the normalization of machinery speeds, considered, of course, as of prime importance in arriving at favorable production costs.

Business Experiencing Strong Upward Trend

According to a statement issued by Secretary of Commerce Whiting, business in the United States is steadily mounting, and is accompanied by evidence of stability and strength. In addition, the secretary reports that the presidential election is not affecting business.

Some of the data indicating the upward trend of business, as cited by Secretary Whiting, is as follows: Production of pig iron was 102,214 tons for September, a record figure. This activity is reflected in the steel industry where plants are operating at 85 per cent capacity. The Regional Advisory Board estimates car loadings at 9,279,000 cars during the last quarter, which is larger than for the similar period of last year. Dividend and interest rates scheduled for distribution to investors during October total $587,000,000, which is also larger than in any previous October.

Standardization Progressing in Italy

THE director of the French Bureau of Normalization in the Automobile Industry, as the result of a recent visit to Italy, where he inspected the chief automobile plants, has just issued an important report on the progress of normalization [standardization] in that country. There has already been in existence for some months a Central Italian Bureau of Normalization which has established a series of *normes* which have been generally adopted in the metallurgical, machinery, aviation, chemical and other industries.

From the point of view of the automobile industry itself, this general government bureau functions only in a purely administrative manner and, having so wide a field of operation, fails of a rapid dissemination and adoption of the detailed application of normalization, or standardization, as known elsewhere in the industry.

It has accordingly been decided that the Italian automobile industry of itself should establish an independent normalization bureau following in its general lines that which was incorporated in France in 1926 by the French Syndical Chamber of Manufacturers of Automobile Parts. The Italian normalization bureau is in close co-operation and more or less under the control of the government organism and will within a short time have established a complete normalization system applicable to all phases of automobile production.

These automobile normes, however, will be considered only as provisory pending their acceptance and approval by the government bureau, but from this time the industry will be in possession of specifications and details which will have all the advantages of a legal, or rather custom-accepted, standardization scheme.

Resulting from negotiations between the French and Italian automobile normalization bureaus referred to, close cooperation between the motor car builders of both countries is bound to be brought into being, and an effort will be made to reconcile and codify as many internationalized normes as may be practically possible.

The French bureau is already working in close alliance with the Belgian constructors' organization along similar lines, and now there has actually been brought into being a tri-parte economic alliance which may be but the forerunner of many others in a far-reaching international producers' cartel.

It may be explained that these countries where standards of measure are invariably and irreconcilibly metric, the normes and standards of America and Great Britain are manifestly not susceptible of application owing to the impossibility of reconciling inches and centimeters in anything but approximate round figures.

In any event what has come to pass is an indication of a disposition on the part of various European political divisions to draw together on many economic measures tending to a joint prosperity or at all events for convenience and commodity. For the want of a more specific definition, it may be called a cordial commercial and industrial collaboration regardless of whatever place the competitive factor may occupy.

Industrial Employment Increased in August

Employment in manufacturing industries increased 1.5 per cent in August, as compared with July, and payrolls increased 3.2 per cent, according to returns made to the Bureau of Labor Statistics. Increased employment in August is usual, but the increase this year is significantly greater than in any of the last five years, and a greater number of separate industries reported increases in August than in any month since October, 1925. One of the outstanding increases was shown in the automobile industry.

Employment in machine tool plants fell, the index being 97.2, as against 102.8 in July, but 82.6 in August, 1927. Employment in foundries and plants making machine shop products has remained on a level, the index being about 80. The index figure for the automomile industry was 91.4 in August, as against 88.5 in July, and 83.0 in August a year ago.

Government Specifications Revised

United States Government Master Specification for Hack Saw Blades (Federal Specifications Board Specification No. 415a) has been revised over F.S.B. Spec. No. 415, issued in 1926. The technical requirements of this revision shall become mandatory for all departments and independent establishments of the government not later than Jan. 2, 1929. Copies of the specification may be obtained from the Federal Specifications Board, Bureau of Standards, Washington.

Atlanta City Advertising Produces Results

The "Forward Atlanta" Commission of the Industrial Bureau of the Atlanta Chamber of Commerce issued a report recently concerning the results of the national trade and class paper advertising campaign the city of Atlanta is conducting to attract new industries, showing that in the two and three-quarters years the campaign has been in progress, January, 1926, to September, 1928, nearly 500 new concerns have located in Atlanta. These concerns employ about 13,000 persons and have an annual total payroll amounting to nearly $25,000,000. In this campaign a fund of $1,000,000 subscribed by Atlanta business firms is being invested, trade and class papers reaching the industrial fields being the principal advertising mediums used. So far this year, average payrolls have been added by new concerns locating in Atlanta amounting to almost $1,000,000 per month.

Manly Award for Paper on Aeronautical Engines

By action of the Council of the American Society of Automotive Engineers, a Manly Memorial Medal is to be given each year to the author of the best paper relating to the design or construction of, or research on, aeronautical engines or their parts or accessories. The medal is intended to provide incentive for original work in the field in which the late Charles W. Manley has contributed so much. One of his earliest achievements was the development of an engine for Langley's "aerodrome." He was president of the S.A.E. in 1919 and has held many committee positions with the society. A fund of $7,500 is to be raised to establish the memorial.

Financial Notes

The Independent Pneumatic Tool Co., Chicago, has declared regular quarterly dividend of $1, payable Oct. 1 to stock of record Sept. 22.

The Indian Motocycle Co., Springfield, Mass., reports net profit of $105,643 for the first half of 1928, including profit of $35,183 from the sale of stock of Wire Wheel Corporation of America. This is equal, after preferred dividends, to 80 cents a share on the common.

In commenting on the progress made by the company this year, S. Duncan Black, president of the Black & Decker Manufacturing Co., Towson, Md., stated that the net sales for the company for the quarter ending Sept. 30 were 25½ per cent greater than for the same quarter of last year. Domestic business is well ahead and very substantial increases have been shown in Canadian and export fields. At the quarterly meeting of the board of directors held Sept. 18, the regular dividend of $0.50 per share was declared on the preferred stock of the company and the common stock dividend was increased from $0.20 to $0.25 per share for the quarter. Net earnings for the fiscal year ending Sept. 30 have been at the rate of approximately $3.35 per share of common stock. The increased dividend to $1.00 per share per annum, therefore, is conservative.

The Otis Elevator Co. reports for nine months ended September 30, 1928, net income of $5,614,762 after depreciation, federal taxes and reserves for pensions, equivalent after 6 per cent preferred dividend requirements, to $12.31 a share (par $50) earned on 432,181 shares of common stock. This compares with net income of $4,059,113 in first nine months of 1927.

The Business Barometer

The outlook in Commerce, Finance, Agriculture and Industry

By THEODORE H. PRICE

Editor, Commerce and Finance, New York

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A SEAT on the New York Stock Exchange sold for $450,000 last week, and it is predicted that $500,000 will soon be reached. Interest rates are somewhat lower for both call and time money. The advance in stocks has been resumed, and the possibility of a further increase in brokers' loans is regarded with equanimity.

In the commercial as distinguished from the financial field, business is looking up. Car loadings are running ahead of last year. Railroad earnings are increasing. Chain stores and the mail order houses are reporting large sales, and a feeling of optimism is pervading all lines of the distributive trade. The government crop report issued last week indicates that the total agricultural production this year will be about the largest on record, and the same may be said of the farmers' purchasing power when allowance is made for the appreciation of the dollar since the boom days.

The New Bedford strike is ended. September sales of cotton goods were half as much again as production. Less is heard of curtailment in the textile industry and the Government estimate of the cotton crop has at least banished the fear of an excess of supply of the raw material.

The steel industry is in excellent shape with a satisfactory backlog of orders. The automobile business is booming. Both will probably make new high records in output this year. There is no abatement of building activity, for the falling off that many forecasters have been predicting because of dearer money is not yet visible in the statistics. Nor is there any abnormal unemployment, and the outlook is about as flawless as it has ever been in this country.

An announcement was recently made that a prominent banking house is offering shares in a large corporation that has been organized to lend sums of less than $300 to wage earners and others who compose a large class that was formerly compelled to live within its earnings, except as it could obtain accommodation from those who serve it.

This is the second step in a movement in which installment buying was the first, and it may be all right. But those who were taught that "borrowing dulls the edge of husbandry" will suspend judgment until they become convinced that thrift is encouraged by making it easy to get into debt.

Thus far, however, the widening use of credit has not had any discoverable effect upon the price of staple commodities. Few have declined, but they have only advanced when there was some special reason for the advance.

Cotton rose upon the issuance of the Government estimate published October 8, but it reacted when it became apparent that the South was willing to sell on the basis of about 19c. for December delivery in New York.

WHAT'S DOING IN INDUSTRY

LITTLE change has taken place in the machine tool trade in the past week. Nearly all centers of the country report continued active sales with bright prospects for a closing quarter that will be a fitting climax to an unusually active year to date. In only one center, the South, is there less activity in the sale of metal-working machinery than there was in the preceding summer months. There, sales to textile firms are predominant.

IN DETROIT business in tools is still good, although not up to August and September volume. Automotive activity, particularly on the part of Ford, is keeping many of the small shops busy with resultant orders for machine tool builders. All the automobile plants are working at capacity, and over, and employment, while it has ceased to rise, is still at a record level. Similar plants in Indianapolis are keeping up the market there, and the radio industry is also becoming a considerable factor. As a result business in machine tools in Indianapolis is better than in some months.

NEW ENGLAND activity continues at a satisfactory level, with inquiries in good volume pointing to future orders, particularly in view of plans for the construction of many new plants. In Chicago, also, business compares favorably with the last half of September, the chief demand being for automatic screw machines. The market in Cincinnati after a temporary slump has livened up considerably with strong sales and many inquiries. New York reports an optimistic outlook after an active summer. In Canada, September has been the most active month in iron and steel since 1920. One of the apparent causes is the large-scale buying of railroad equipment and rolling stock. The railroad market in the United States, however, remains weak.

The grain markets have moved within narrow limits. Sugar is still somnolent, at around 2⅞c. for Cuban raws landed at New York, and at that figure the demand seems to be about equal to the offerings.

Rubber has been rather steadier, at a slight improvement, which is said to reflect the extraordinary demand for automobile tires. The price of coffee has become entirely dependent upon the support given it by the political powers that be in Brazil. A decline would certainly follow if that support were withdrawn, and American consumers are buying from cup to cup.

Silk has changed but little, and the dullness of speculation on the commodity exchanges is one of the features of the situation.

Just how long it will last, no one can say, but it seems altogether probable that some of the money that has been made on the Stock Exchange will soon begin to seek investment elsewhere. If this expectation should be realized, an upward movement in merchandise will be logical, and it may come sooner than is now anticipated.

The political developments have not yet had any effect upon business. The heavy registration in some States is interpreted by the Democrats as foreshadowing the election of Smith and by the Republicans as portending the success of Hoover. But no one knows what it really means, nor is anyone much afraid of the popular verdict that will be given on Election Day.

In Europe, the status of economic affairs is almost as satisfactory as it is here. Some important issues will be decided at the general election that is shortly to be held in Great Britain, but no one is apprehensive of the result.

London is sending us some gold. The amount is not expected to be large enough to relax our money markets, but it seems probable that our credit situation will right itself when the crop movement subsides. Meanwhile, the Federal Reserve Banks see to it that there is abundant commercial accommodation at rates lower than those charged to stock market borrowers and the tightening of money obviously is not checking business.

The prosperity of Canada is remarkable. It adds to the stability of business in the United States, and as conditions in Mexico are somewhat improved, the outlook on the North American Continent appears to warrant confidence and justify hope.

The Industrial Review

Weekly progress of the machinery and machine tool business

THE following reports, gathered from the various machinery and machine tool centers of the country, indicate the trend of business in these industries and what may be expected from the future:

SOUTHERN DISTRICT

The early part of October found the machinery and machine tool business in the Southern district less active than it has been for some time. Distributors stated that the money situation is rather tight in the South at this time, probably due to the approaching election, and that this is having an adverse affect not only on the machinery business but on most other industries as well. This situation is particularly noticeable in the building field, construction in the Southeast having slowed up considerably the past two or three weeks because not as much money is available for building, this condition adversely affecting the sale of equipment to contractors. Few look for any marked improvement in business until the election is over, and possibly not before the early part of the coming year.

Textile mills continue their extensive building program in the Southeast and some sales of new equipment are being made in this field, with the outlook very bright for the first few months of next year. In the smaller machine shop and garage field, however, but little buying is being done, nearly all present orders booked being for either used or rebuilt equipment. Railroads are also less active in the market than they were, though are still placing an occasional good order for heavy equipment.

In the woodworking field sales are now about on a normal basis, but considerably less than they were at this time last year, at which period the industry saw a revival of trade that made business the best in years during the last few months of 1927 and the first few months of 1928. Most sales are in the furniture and sawmill field, other branches of the woodworking industries buying but little at this time.

CANADA

Buying of railroad equipment and rolling stock on a large scale is the outstanding feature of the Canadian metal-working situation at present. For several years past the railways have been limiting their expenditures on new rolling stock to a minimum, but the large increase in earnings since last year, and the necessity of replacing a lot of obsolete equipment, has brought about a buying movement that will be extensive for many months to come.

In addition to recent purchases, the Canadian National Railways are calling for tenders for box, refrigerator, baggage, Pullman and tank cars, numbering about 2,100 in all. The Canadian Pacific Railway is understood to be drawing up plans which will call for the placing of orders for rolling stock on a scale far in excess of anything in recent years. The Montreal Locomotive Works is building 20 new engines as a first consignment on an order of 55 for the C.N.R., and have just delivered the first of 25 freight locomotives for the C.P.R. The Canadian Locomotive Co., of Kingston, Ontario, has booked an order for 15 locomotives of the Santa Fe 2-10-2 type, and ten locomotives of the 8-wheel switching type for the C.N.R.

The iron and steel companies report that the amount of new business being received for fall and winter delivery is greater than last year. Steel warehouses report a high average of business. One prominent firm reports that business during September was the heaviest on record since 1920. It is the general consensus of opinion that the opportunity for bridge companies and steel companies, as well as for rail mills, was never so great as at the present moment. Never before has there been such a variety of possible contracts in the offing as at present.

Owing to the unprecendented demand for farm implements, stocks are low and manufacturers are very busy. Belting manufacturers also report excellent business during the last few weeks.

DETROIT

Conditions in the machinery and machine tool trade are still very good in Detroit and Michigan, but it is doubtful if they are quite as good as they have been during September and August. There seems to be just a little let down, and though many orders for large amounts of equipment are coming constantly, there is some evidence that dealers are getting their orders filled with a little greater speed.

The small shops are still extremely busy, many of them working overtime for long periods, and there are still a number of new ones starting in business, principally because of the activities of the Ford Motor Co. Ford is still letting out much work in an effort to boost his production, which is rising rapidly.

Chevrolet is buying a good deal of equipment, as are also Dodge, Chrysler, Graham-Paige, and most of the body builders. Employment is no longer rising, as it has been during the entire year, but most plants are at capacity.

CHICAGO

That business in machine tools thus far in October compares favorably with that of the last half of September is the generally expressed opinion of machinery men. In some lines there has been a slight decrease in the number of orders, but practically the same high level that prevailed in September is being maintained. It is noted that the types of tools that have been in greater demand are still to the fore.

The call for automatic screw machines continues insistent, and plants producing these tools are said to be far behind in their deliveries. Demand for punch presses is larger than for some time past, and dealers in used machinery are finding a good market for tools of this type in first class condition. The railroad situation remains unchanged, the only new list reported being from the Chicago, St. Paul, Minneapolis and Omaha Railroad. Other roads continue buying against lists issued several weeks ago. Demand for grinding machines shows practically no abatement, automotive and auto accessory plants being the leading buyers. Business in used tools has fallen off somewhat, but the decline is believed to be only temporary.

INDIANAPOLIS

The last two weeks have seen a good increase in sales of machinery and machine tools in this territory. In fact, business is better here than it has been for some months. The thing that encourages the dealers is the fact that sales are coming from more diversified lines of industry, and the demand is for more volume than usual.

The automobile industry is in good shape, judging from the orders being received. The last two weeks have shown an increase in the demand, and production is being speeded up among the Indianapolis factories, and also in Newcastle and South Bend.

A rather new source of demand is being developed in this state, namely the radio industry. Several factories have sprung up during the last few months and apparently they all are doing a good business, judging from the demand for special machinery. This is particularly noticeable in the demand for woodworking machinery, which is being sold to the radio factories and to the cabinet factories that are making radio supplies.

The volume of sales to lumber factories is good, better, in fact, for this season than it was last year. While the iron and steel demand is somewhat spotted, there are many signs which point to more prosperous times. The farm implement demand continues good, with production being increased gradually.

NEW ENGLAND

The first half of October has been just as satisfactory from an order point of view, and continues as promising as the very good months of August and September. An unabated demand for a large assortment of miscellaneous small units is still the particular feature of the New England machinery market. Parts manufacturers within the aeronautical and automotive fields are buying a good part of these machines, but other industries are well represented. There is every reason to believe this excellent demand will continue. There is also a satisfactory sprinkling of orders for large high-production machines.

Improved buying has come from several Massachusetts machine shops and parts manufacturers. Planned construction for additions by plants in this field at Worcester, Springfield, Watertown and Everett will bring more orders. Connecticut dealers and manufacturers received orders from this source in the past week. A New Haven company bought several small presses aggregating $7,000.

The radio, aeronautical and automotive industries are the leading buyers in the New England territory. As a whole, the volume, however, is well divided among an increasing number of industries. The automobile repair trade is taking a good supply of bench tools. A recent improvement mentioned in the textile buying field continues to show gradual expansion.

CINCINNATI

Reports of machine tool manufacturers of the Cincinnati district as to the volume of business done in the past week are very cheerful almost without exception. The great majority of the concerns reported that the market livened up in an encouraging way, and there was, in no case, the statement that sales had fallen off. A decided feeling of optimism prevails in the trade and the common market forecast is that business is about to pick up more than a little.

Selling agents report that business is better than usual, with a decided tendency toward a livelier market and a larger demand in local and adjacent territory. A typical opinion is that of the head of a leading house in this branch of the trade, who said, "Business is good now and it looks to me as though it will remain at a good level for some time."

Although during the past week there were received a number of orders which called for two or three tools, the sustaining feature of the market was the sale of single tools. The great majority of the buyers were general machinists and miscellaneous users.

located in all sections of the country, whose purchases were well diversified in the matters of sizes and types. There was a slight increase in the sales to concerns in the automotive industry and its allied trades, the purchases being almost entirely confined to single tools and replacements.

Manufacturers report that inquiries came in freely from all sections of the country. An increased number of inquiries came from the automobile field.

NEW YORK

Prospects for continued good business for the fall and winter are bright in the New York district despite the fact that actual sales during the past two or three weeks have not been up to the exceptionally good standards of the early summer months. Total sales for the year, however, will easily surpass those of the year 1927, it is prophesied at this early date. All companies report inquiries and sales as general and varied, with nothing unusual in the situation. The small manufacturers and jobbing shops in the immediate vicinity of New York City are reported as booming, and continuously in the market for occasional machines of all kinds.

The Pratt and Whitney Co. reports the sale of a 13x30-in. lathe, two 1x18-in. automatic latnes, one 7x32-in. bench lathe, two 6-in. vertical shapers, two 14-in. vertical surface grinders, eight No. 11 multiple spindle drills, one No. 2 jig borer. The Niles Tool Works Co. sold one 62-in. standard boring mill, one HB4 floor borer, two Boye and Emmes 18-in.x6-ft. lathes, one Boye and Emmes 24-in.x10-ft. lathe, one Blount 11-in.x4-ft. speed lathe, one U. S. 7-in. pedestal grinder, one Grand Rapids No. 5 wet surface grinder, one Grand Rapids No. O-6-A drill grinder, one 36-in. Niles Acme shaper, and one Morris 4-ft. heavy duty radial.

There are no outstanding buyers at the present moment in the New York market. Sales are quite general and are well deversified. Inquiries indicate bright prospects ahead in all lines. The railroads are normal in that they are buying occasionally. All firms report that the election is having no effect whatsoever upon the buying of equipment.

Seek Sources and Uses of Illinium

Intensive research work to develop illinium, element 61, discovered two years ago by Prof. B. S. Hopkins of the University of Illinois, has been started in the university laboratories at Champaign with a staff of seven under Professor Hopkins' direction. Dr. L. L. Quill, who received his degree last spring, is devoting full-time to the research; five students in graduate studies are doing part time and two laboratory research assistants comprise the staff. Work is directed to uncover more substances from which illinium may be derived; improvement of methods of concentration and study of other ores in hope of finding new sources of supply are other lines of the work.

Black & Decker Acquire Domestic Electric Co.

The Domestic Electric Co., located at 7223 St. Claire Ave., Cleveland, Ohio, has been merged with the Black & Decker Manufacturing Co., of Towson, Md., according to a statement by S. Duncan Black, president of the latter concern. The Domestic company, of which Carl A. Duffner is president, makes fractional-horsepower motors for electric portable tools and appliances, and through its acquisition, the Black & Decker concern becomes a self-contained unit. Both companies have been successful financially. Mr. Duffner will remain in his present capacity, as will Milton H. Speilman, vice-president. The Black & Decker company also owns the Van Dorn Electric Tool Co., which it acquired during the past year. The purchase price of the Domestic company was in the neighborhood of two million dollars.

Georgia Manufacturers Plan Merchandising and Sales Conference

An important merchandising and sales conference at which the leading industries of the South will be represented is to be held at the Atlanta-Biltmore Hotel in Atlanta on Thursday, Nov. 22, under the direction of the Georgia Manufacturers Association, it is announced by J. P. McGrath, executive secretary of the organization. The machinery, foundry and kindred industries of the Southeast will be well represented at the meeting. Officers and directors of the above association are members of the committee in charge. They include Robert Gregg, president of the Atlantic Steel Co., Atlanta, and Bryan Blackburn, of the R. D. Cole Manufacturing Co., Newnan, machinery manufacturers, both of whom are vice-presidents of the association; and the following directors: H. A. Dean, Towers & Sullivan Manufacturing Co., Rome; T. E. Golden, Golden Foundry & Machine Co., Columbus; Horace Lanier, West Point Iron Works, West Point, and John S. Schofield, J. S. Schofield & Son Co., machinery manufacturer of Macon. Other members of the committee include Fairfax Harrison, Washington, D. C., president of the Southern Railway System, and J. J. Pelly, Savannah, president of the Central of Georgia Railway Company.

American Labor Shares in Production Profits

The basic data on American operations gained by the United States Census Bureau through its bi-annual Census of Manufactures taken at the close of last year are now being made public by industries and industrial groups. The data picture the trends witnessed by the industries of the nation during the two-year period of industrial prosperity—1926 and 1927.

The reports issued so far covering 30 industrial groups indicate that the number of plants in these industrial groups has dropped from 2,303 at the close of 1925 to 2,231 at the close of 1927. This is close to the same rate of decrease which was reported for all industry during the 2-year period, 1923-1925. If this rate is maintained the total number of manufacturing plants in the nation with products valued at over $5,000 per annum at the close of 1927 should total around 181,700, or a reduction of about 5,700 since 1925 and 31,900 plants since the close of the War.

There has also evidently been a reduction in the number of wage earners in manufacturing plants. From 1925 to the end of 1927 this reduction was around 1 per cent which would indicate a total number of wage earners in manufacturing plants at the close of 1927 of 8,300,000, or a reduction of 700,000 since the close of the War. There has been a very material increase, however, in the number employed in occupations other than manufacturing—the so-called "public service occupations."

The groups for which data are available indicate that the average amount of wages received per employee in 1927 was about $1,285, as against $1,164 in 1919, an increase of 10.4 per cent. This fact is even more striking when it is remembered that the cost of living since the War has actually declined 6 per cent, and is 21 per cent under the peak of 1920. In other words, not only does the average employee in American manufacturing plants receive substantially more wages than eight years ago, but the commodities which he can purchase with each dollar of these wages has also very materially increased.

Another significant fact brought out by these advance figures is that in 1927 the average employee added $3,060 to the value of the raw products used in manufacture, while in 1919 the value added per employee was only $2,750, showing a gain of 11.2 per cent. In the resultant of these two statements is to be found one of the basic influences underlying the present prosperity of American industry. The American laborer has fully shared in the results of his efforts. He has increased his productive value to his employer by 11.2 per cent, and his employer has in turn increased the employees wages by 10.4 per cent. American labor has shared fully in the increased increment to the manufacturer, and in this sharing of profits the nation has exhibited a fundamental in the relationship between capital and labor which is not shared in European countries.

One of the basic reasons for this increased value of products produced per employee and resulting in increased wages per employee is the materially increased use of power per employee. In 1927, according to the incomplete figures there was a total of 5.33 hp. installed per employee as against 3.26 hp. in 1919, or an increase of about 64 per cent.

Ford Production Increasing

Production of Ford's new cars and trucks was at the rate of 5,500 per day during the first week of October. Every Ford assembly plant in the world was stated to be in operation on Oct. 1, and indications are the next few months will see the previous record of 8,500 cars, established in 1926, surpassed. Since the first of this year approximately

500,000 cars and trucks have been built.

According to information covering the first week in October, payrolls are higher than ever, and there are more men employed in Ford factories than ever before. In the Detroit plants alone 125,000 men are at work.

American Brown Boveri Forms Shipbuilding Subsidiary

The American Brown Boveri Electric Corporation has separated in electric and shipbuilding activities by organizing a subsidiary, completely owned, under the name of New York Shipbuilding Co., leasing to the new company all real estate and plant embraced in the active shipbuilding facilities at Camden, N. J. The shipbuilding company will take over and complete all existing ship contracts for American Brown Boveri. Management includes: W. M. Flook, chairman; C. L. Bardo, president; J. E. Slater, vice-president and treasurer; E. I. Cornbrooks, vice-president and general manager; M. H. Torbet, assistant general manager; E. H. Rigg, naval architect; Norman R. Parker, comptroller and A. G. Connell, secretary.

To Study Engineer's Status in Industry

As a part of a plan to asceretain the status of the mechanical engineer in industry, members of the Machine Shop Practice Division of the American Society of Mechanical Engineers are being canvassed by a questionnaire calculated to learn the ages and salaries of men engaged in specific positions in the machine shop field. The questionnaires are to be compiled without signatures. The findings are to be compiled in a general report.

U. S. Chamber Holds Councillors' Conference

National councillors of the U. S. Chamber of Commerce are a vital element in its work. They are the link between the national body and the constituent organizations—local chambers of commerce and trade associations. The second annual conference of national councillors, held in Hot Springs, Ark., Oct. 8 and 9, was an effort to maintain interest. The meeting, according to both officers and councillors, was very effective.

One day was given to discussion of agriculture, state and local taxation, street and highway traffic, the Federal Reserve system, distribution and air transport regulation; and the other, to improvement in the chamber's own mechanism. There were excellent reports on the responsibility of national councillors, on the desirability of committees on national legislation in all member bodies and on method of getting consideration for referenda.

Three hundred and forty-five were in attendance and the sessions were presided over by William Butterworth, of Moline, Ill., president, and by Robert R. Ellis, Memphis, and Robert P. Lamont, Chicago, vice-presidents.

Business Items

The Century Electric Co., of St. Louis, has opened an office at Spokane, Wash., in Room 709 Hutton Bldg., Sprague and Washington Sts. The territory was formerly covered by an agency.

The Whiting Corporation, Harvey, Ill., has appointed the D. S. Mair Machinery Co., Houston, Texas, as its agent in Texas. The latter company will handle the complete Whiting and Swenson lines.

A contract for the riveting on the Detroit-Windsor tunnel has been awarded to the Dominion Welding & Engineering Co., control of which has been acquired by the Dominion Engineering Works, a subsidiary of the Dominion Bridge Company.

The Hope Engineering Co. has sold the manufacturing end of its business, at Mt. Vernon, O., to C. & G. Cooper Co., which will continue the manufacture and distribution of the Hope gas engines and compressors in addition to its present lines, while the Hope Engineering Co. will further develop its engineering business.

The Gibbs Machine Co. was organized and incorporated recently at Greensboro, N. C., with a capital stock of $100,000 to take over the plant of the R. A. Gibbs Machine Co., of that city, operation of which will be continued by the new concern. Incorporation include John G. Bentley, 207 North Park Drive, Greensboro; R. A. Gibbs, Jr., also of that city, and others.

Orders received by the General Electric Company for the three months ended September 30 amounted to $90,328,666 compared with $77,420,263, for the corresponding quarter of 1927, an increase of 17 per cent, President Gerard Swope has announced. For the nine months ended September 30 orders received amounted to $260,686,463, compared with $233,076,091, for the first nine months of last year, an increase of 12 per cent.

Personals

CAPT. T. NAGAO of the Japanese navy attended the opening session of the American Welding Society.

ROSS H. MCMASTER, president, Steel Co. of Canada, has been elected a director of the Canada Steamship Lines to fill a vacancy which has existed for some time.

A. B. ROOT, JR., formerly assistant to the vice-president of the Hunt-Spiller Manufacturing Corporation, South Boston, Mass., has been appointed assistant general manager.

J. PESKINE, managing director of R. S. Stokvis & Fils, Paris, will sail for New York next week to renew acquaintances in the United States. His address will be in care of R. S. Stokvis & Sons, Inc., 17 Battery Place, New York.

WILLIAM H. WOODIN, JR., son of W. H. Woodin, president of the American Car & Foundry Co., New York, has been appointed director of research for the company with headquarters at 30 Church St. H. Wobbe will be assistant director.

CHARLES WARDLOW, managing director of S. & C. Wardlow Ltd., Sheffield, Eng., one of the oldest makers of cutlery and hacksaw sheet steel in Sheffield, the company having been in existence since 1833, was a visitor at the National Metal Exposition in Philadelphia.

W. A. OSBOURNE has been appointed manager of the Toronto office of Babcock-Wilcox and Goldie-McCullough, Ltd., of Galt, Ontario, in succession to G. G. Mills who has resigned to enter the financial field. Mr. Osbourne has been with the company a number of years.

A. P. NEWALL, managing director, Woodside Engineering Works, Possilpark, Glasgow, Scotland; GUSTAV G. V.D. PFORDTEN, technical director, Fr. Karcher and C. Roth & Co., Beckingen, Saar, Germany; and M. KOCIAN, engineer, G. Nedele, Praha, Russia, representing the Soviet government, were among the foreign visitors at the National Metal Exposition.

E. N. BENDER, general purchasing agent of the Canadian Pacific Railway, Montreal, has resigned after 47 years in the service of the company. In 1880 Mr. Bender entered the service of the Quebec, Montreal and Occidental Railway, which was later taken over by the C.P.R. In 1902 he was appointed general purchasing agent, which position he held until his resignation.

B. W. ROBERTS has been appointed general purchasing agent of the Canadian Pacific Railway, Montreal, in succession to E. N. Bender, who has resigned. Mr. Roberts has had wide experience with the purchasing department of the railway. He entered the company's service in 1907 as a clerk in the treasury department. Several promotions followed, and in 1923 he was appointed assistant general purchasing agent.

Obituaries

EUGENE D. STOCKER, president of the U. S. Hoffman Machine Co., died on Oct. 8 after a long illness.

R. E. LEBLOND, father of R. K. LEBLOND, president of the R. K. LeBlond Machine Tool Co., Cincinnati, O., died on Oct. 6, at the age of 88 years. He had been retired for many years.

THOMAS C. DEXTER, aged 80, one of the founders of the Dexter Folder Co., of Pearl River, N. Y., died on October 10 from injuries received in New York City when he was run down by a truck. He had been connected with the Dexter firm for thirty-nine years and was well known in the publishing and book-binding world. The concern has a modern metal-working shop and formed the town's chief industry.

Forthcoming Meetings

Society of Industrial Engineers. Fifteenth annual convention, Rochester, N. Y., October 17-19, in conjunction with the Industrial Management Council of the Rochester Chamber of Commerce. George C. Dent, executive secretary, 205 Wacker Drive, Chicago.

National Manufacturers' Association. Combined assembly with the National Industrial Council in New York City, October 22-24. George S. Doudinot, secretary, 11 W. 42nd St., New York City.

American Management Association. Autumn convention, Palmer House, Chicago, Nov. 13-15. W. J. Donald, managing director, 20 Vesey St., New York City.

Iron and Steel Division, American Society of Mechanical Engineers. Second national meeting, Chicago, November 14-15. Thomas Wilson, chairman of Chicago local section, host, 7 S. Dearborn St., Chicago.

Society of Automotive Engineers. Production meeting, Book-Cadillac Hotel, Detroit, Mich., Nov. 22-23. Coker F. Clarkson, secretary, 29 W. 39th St., New York City.

American Society of Mechanical Engineers. Annual meeting, Engineering Societies Bldg., New York, week of Dec. 3. Calvin W. Rice, secretary, 29 W. 39th St., New York City.

Seventh National Exposition of Power and Mechanical Engineering. Held at Grand Central Palace, New York, N. Y., week of December 3.

The Weekly Price Guide

Rise and Fall of the Market

FINISHED steel quotations are holding firmly to the new levels established Oct. 1, with an advance of 5c. per 100 lb., Pittsburgh, on the principal hot-rolled materials. With prices higher and the rate of mill operations at least 10 per cent above seasonal normal, demand is seen to increase in several specific lines, namely, rails, railing material, machine tool material and fabricated structurals, particularly for bridge construction. Continued firmness in steel is foreseen in the present stiffening of pig iron prices due to scarcity. Non-ferrous metals prices tend upward, affecting solder, babbitt metal and scrap. Wiping cloths and linseed oil were the principal non-metallic materials to show price advances during the week.

(*All prices as of Oct.* 13, 1928)

IRON AND STEEL

PIG IRON—Per gross ton, f.o.b.:

CINCINNATI	
No. 2 Southern	$19.94
Northern Basic	20 89
Southern Ohio No. 2	21.19
NEW YORK—Tidewater Delivery	
Southern No. 2 (silicon 2.25@2.75)	25.12
BIRMINGHAM	
No. 2 Foundry	16.25
PHILADELPHIA	
Eastern Pa., No. 2x (silicon 2.25@2.75)	20.76
Virginia No. 2	27.17
Basic	20.76
CHICAGO	
No. 2 Foundry local (silicon 1.75@2.25)	20.00
No. 2 Foundry, Southern (silicon 2.25@2.75)	22.51
PITTSBURGH, including freight charge ($1.76) from Valley:	
No. 2 Foundry	19.26
Basic	19.26
Bessemer	21.26

IRON MACHINERY CASTINGS—Cost in cents per lb. o 100 flywheels, 6-in. face x 24-in. dia., hub not cored, good quality gray iron, weight 275 lb.:

Detroit	4 50
Cleveland	5.00
Cincinnati	4.30
New York	5.25
Chicago	4.50@4.75

SHEETS—Quotations are in cents per pound in various cities from warehouse; also the mill base in large lots.

Blue Annealed	Pittsburgh Mill Base	Chicago	Cleveland	New York
No. 10	2.00	3.35	3.25	3.90*
No. 12	2.05	3.40	3.30	3.95*
No. 14	2.15	3.45	3.35	4.00*
No. 16	2.25	3.55	3.45	4.10*
Black				
Nos. 18 to 20	2.55	3.60	3.30	4.00
No. 22	2.70	3.75	3.45	4.15
No. 24	2.75	3.80	3.50	4.20
No. 26	2.85	3.90	3.60	4.30
No. 28	3.00	4.05	3.75	4.45
Galvanized				
No. 10	2.70	3.95	3.65	4.25
Nos. 12 to 14	2.80	4.05	3.75	4.35
No. 16	2.90	4.15	3.85	4.45
No. 18	3.05	4.30	4.00	4.60
No. 20	3.20	4.45	4.20	4.75
No. 22	3.25	4.50	4.25	4.80
No. 24	3.50	4.65	4.35	4.95
No. 26	3.65	4.90	4.60	5.20
No. 28	3.90	5.15	4.85	5.45

250 to 3,999 lb.

WELDED STEEL PIPE—Warehouse discounts are as follows:

	New York Black	New York Galv.	Cleveland Black	Cleveland Galv.	Chicago Black	Chicago Galv.
1 to 3 in., butt welded	50%	36%	55½%	43½%	54%	41%
2½ to 6 in., lap welded	45%	32%	53½%	40½%	51%	38%

WROUGHT-STEEL PIPE LIST

Size, Inches	List Price per Foot	Diameter in Inches—External	Diameter in Inches—Internal	Thickness Inches
1	$0.17	1.315	1.049	.133
1¼	.23	1.66	1.38	.14
1½	.27½	1.9	1.61	.145
2	.37	2.375	2.067	.154
2½	.58½	2.875	2.469	.203
3	.76½	3.5	3.068	.216
3½	.92	4.0	3.548	.226
4	1.09	4.5	4.026	.237
4½	1.27	5.0	4.506	.247
5	1.48	5.563	5.047	.258
6	1.92	6.625	6.065	.28

SEAMLESS STEEL TUBING—Following net prices are for seamless mechanical tubing, cold drawn, round, .10 to .30 carbon, at New York warehouse in lots of less than 100 ft. or 100 lb.:

Thickness—Decimal	B.w.g. and Fractions	Outside Diameter in Inches—½	⅝	¾	⅞	1	1⅛	1¼
		Price per Foot						
.035″	20	$0.15	$0.16	$0.17	$0.18	$0.19	$0.21	$0.23
.049″	18	.17	.18	.19	.20	.21	.23	.25
.065″	16	.19	.20	.21	.22	.23	.25	.27
.083″	14	.20	.22	.23	.24	.25	.27	.29
.095″	13	.21	.23	.25	.26	.27	.29	.31
.109″	12	.22	.24	.26	.27	.28	.30	.32
.120″ or .125″	11	.23	.25	.27	.28	.29	.31	.33
.134″	10	.24	.26	.28	.29	.30	.32	.34

MISCELLANEOUS—Warehouse base prices in cents per lb.:

	New York	Cleveland	Chicago
Spring steel, light*	4.50	4.65	4.65
Spring steel, heavier	4.00	4.00	4.00
Coppered Bessemer rods	6.05	6.00	6.20
Hoop steel	4.50‡	4.00	4.15
Cold rolled strip steel	6.25	6.00	6.10
Floor plates	5.10‡	5.30	5.00
Cold drawn, round or hexagon†	3.40	3.65	3.60
Cold drawn, flat or square†	3.90	4.15	4.10
Structural shapes	3.30‡	3.00	3.10
Soft steel bars	3.25‡	3.00	3.00
Soft steel bar shapes	3.25‡	3.00	3.00
Soft steel bands	4.00‡	3.65	3.65
Tank plates	3.30‡	3.00	3.10
Bar iron (2.75 at mill)	3.24	3.00	3.00
Drill rod (from list)	60%	55%	50%

*Flat, $\frac{3}{16}$@½-in. thick. †Cold finished steel, shafting and screw stock. ‡250 to 3,999 lb., ordered and released for shipment at one time.

Electric welding wire, New York, $\frac{3}{32}$, 8.35c.; $\frac{1}{8}$, 7.85c.; $\frac{5}{32}$ to $\frac{1}{4}$ 7.35c. per lb.

METALS

Warehouse Prices in Cents Per Pound for Small Lots:

Copper, electrolytic, New York			16.00
Tin, Straits, pigs, New York			52.00
Lead, pigs, E. St. Louis	6.32½	New York	8.00
Zinc, slabs, E. St. Louis	6.25	New York	7.75

	New York	Cleveland	Chicago
Antimony, slabs	13.75	13.75	14.25
Copper sheets, base	24.00	23.50	24.00
Copper wire, base	20.62½	19.62½	17.25*
Copper bars, base	22.50	22.00	23.00
Copper tubing, base	25.50	25.00	25.50
Brass sheets, high, base	19.75	19.25	19.75
Brass tubing, high, base	24.62½	24.12½	24.62½
Brass rods, high, base	17.50	17.00	17.50
Brass wire, high, base	20.25	19.75	20.25

*At mill

Shop Materials and Supplies

METALS—Continued

	New York	Cleveland	Chicago
Aluminum ingots, 99%.....	25.00*	24.30	24.30
Zinc sheets (casks).....	10.00@10.50	11.00	10.01
Solder (½ and ½).....	34.75	33.00	31@34

Babbitt metal, delivered in case lots, New York, cents per lb.:

Genuine, highest grade.....	69.00
Commercial genuine, intermediate grade.....	53.00
Anti-friction metal, general service.....	31.50
No. 4 babbitt (f.o.b.).....	12.25

Nickel, f.o.b. refinery, Bayonne, N. J., cents per lb.:

Ingots..... 35.00 Electrolytic.. 37.00 Shot..... 36.00

*Delivered.

SPECIAL NICKEL AND ALLOYS—Price in cents per lb., f.o.b. Huntington, W. Va.:

Full finished nickel sheet (base).....	52.00
Cold rolled nickel sheet (base).....	60.00
Hot rolled rods, Grade "A" (base).....	45.00
Cold drawn rods, Grade "A" (base).....	53.00

Base price of Monel metal in cents per lb., f.o.b. Huntington, W. Va.:

Shot.....	28.00	Hot rolled rods (base)...	35.00
Blocks.....	28.00	Cold drawn rods (base).	43.00
Cold rolled sheets (base)	50.00	Full finished sheets (base)	42.00

OLD METALS—Dealers' purchasing prices in cents per pound, f.o.b. cars, depending on quantity:

	New York	Cleveland	Chicago
Crucible copper.....	13.37½@13.50	12.00	12.25@12.75
Copper, heavy, and wire..	12.62½@13.37½	11.25	11.62½@12.00
Copper, light, and bottoms	11.37½@11.62½	9.75	10.50@11.00
Heavy lead.....	5.25 @ 5.50	5.25	4.75@ 5.25
Tea lead.....	3.50 @ 4.00	3.75	3.75@ 4.25
Brass, heavy, yellow.....	7.25 @ 7.75	7.75	7.50@ 8.00
Brass, heavy, red.....	10.00 @10.50	10.00	10.00@10.50
Brass, light.....	6.25 @ 6.50	16.25	6.50@ 7.00
No. 1 yellow rod turnings.	8.50 @ 8.75	7.75	8.00@ 8.50
Zinc.....	3.25 @ 3.50	3.25	2.87½@3.37½

TIN PLATES—Charcoal—Bright—Per box.

		New York	Cleveland	Chicago
"AAA" Grade:				
IC,	14x20.....	$12.10	$11.95	$11.50
"A" Grade:				
IC,	14x20.....	9.70	9.90	9.50
	Coke Plates—Primes—Per box			
100-lb.,	14x20.....	6.45	6.10	7.00
	Terne Plates—8-lb. Coating—Small lots—Per box			
IC.	14x20.....	7.75@8.00	7.00	7.50

MISCELLANEOUS

	New York	Cleveland	Chicago
Cotton waste, white, per lb.*	$0.10@0.13½	$0.16	$0.15
Cotton waste, colored, per lb.*	.09@ .13	.12	.12
Wiping cloths, washed white, per lb.....	.16@16½	38.00 per M	.17
Sal soda, per lb.....	.02	.02	.02
Roll sulphur, per lb.....	.027	.03½	.04
Linseed oil, raw, in 1 to 4 bbl. lots, per lb.....	.112	.105	.108
Cutting oil, about 25% lard, in 5 gal. cans, per gal....	.65	.60	.60
Machine oil, medium-bodied (55 gal. steel bbl.) per gal.....	.30	.36	.36
Belting—Present discounts from list in fair quantities (½ doz. rolls).			
Leather—List price, 24c. per lin.ft. per inch of width for single ply.:			
Medium grade.....	30–10%	30–10%	35%
Med. grade, heavy wgt.	30–5%	30–5%	30%
Rubber transmission, 6-in., 6 ply, $1.83 per lin.ft.:			
First grade.....	50%	50–10%	50%
Second grade.....	60%	60–5%	50–10%

*All waste in bale lots.

Comparative Warehouse Prices

New York	Unit	Current Price	Four Weeks Ago	One Year Ago
Soft steel bars.....	per lb....	$0.0325	$0.0325	$0.0324
Cold drawn shafting....	per lb....	.034	.034	.04
Brass rods.....	per lb....	.175	.17	.16
Solder (½ and ½).....	per lb....	.3475	.3225	.365
Cotton waste, white....	per lb....	.10@.13½	.10@.13½	.10@.13½
Emery disks, cloth, No. 1, 6-in. dia.....	per 100...	3.05	3.05	3.10
Lard cutting oil.....	per gal...	.65	.65	.65
Machine oil.....	per gal...	.30	.30	.27
Belting, leather, medium.....	off list....	30–10%	30–10%	35%
Machine bolts, up to 1x30 in., full kegs....	off list....	50%*	50%*	50%*

*List prices as of April 1, 1927.

MISCELLANEOUS—Continued

	New York	Cleveland	Chicago
Abrasive materials—Standard grade, in sheets 9x11 in., No. 1, per ream of 480 sheets:			
*Flint paper.....	$4.29	$4.29	$4.29
*Emery paper.....	10.71	10.71	10.71
†Emery cloth.....	20.97	20.97	20.97
Emery disks, 6 in. dia., No. 1, per 100:			
Paper.....	1.32	1.32	1.32
Cloth.....	3.05	3.05	3.05
Fire clay, per 100 lb. bag.....	1.00	.75	.75
Coke, prompt furnace, per net ton...	Connellsville, 2.75@3.00		
Coke, prompt foundry, per net ton...	Connellsville, 4.00@4.50		
White lead, dry or in oil....	100 lb. kegs....	New York, 13.25	
Red lead, dry.....	100 lb. kegs....	New York, 13.25	
Red lead, in oil.....	100 lb. kegs....	New York, 14.75	

*4½ reams and under. †Less than 2 reams.

SHOP SUPPLIES

Discounts from new list dated Apr. 1, 1927, applying on immediate deliveries from warehouse stocks in New York and vicinity:

	Full Kegs or Cases
Machine bolts, square heads and nuts:	
Up to ¾ x 6-in.....	55%
Larger up to 1 x 30-in.....	50%
1¼ and 1½ in. dia.....	35%
Carriage bolts:	
Up to ½ x 6-in.....	55%
Larger sizes.....	50%
Coach and lag screws:	
Up to ½ x 6-in.....	55%
Larger sizes.....	50%
Tap bolts, hexagonal heads.....	40%
Nuts:	
Hot pressed, square and hexagonal, blank or tapped, up to 1-in., incl.....	55%
Cold punched, square and hexagonal, blank or tapped, up to 1-in. incl.....	55%
Semi-finished, hexagonal, tapped, in packages, all sizes.....	40%
Case hardened, hexagonal, tapped, in packages, all sizes.....	30%
Washers: Deduct from list, per 100 lb.....	$3.50*
Rivets, button and cone head:	
Small, including ½-in. dia.....	50–10%
Large (base) per 100 lb. net.....	$5.00†

Note—For less than full package quantities on bolts, screws, hot-pressed and cold-punched nuts, add extra of 10 per cent to list.
*Broken keg lots, $1.50 off list. †Broken keg lots, $6.50 net.

Machine Requirements and Industrial Construction

Equipment Wanted

D. C., Washington—A. L. Flint, General Purchasing Officer of Panama Canal—will receive bids until Oct. 26, for power band saw, reamers, drills, etc., also until Oct. 23, for band saws, diamond drill outfit, etc.

Ill., Jacksonville — Illinois Steel Bridge Co.—10 or 15 ton overhead traveling crane, 70 ft. span.

Ill., Moline — Frank Foundries Corp. — new machinery and equipment (later) for 1 story, 100 x 220 ft. foundry and shipping building now under construction.

Mich., Detroit — Dodge Bros. (Div. Chrysler Motor Car Co., 341 Massachusetts Ave., Highland Park)—automobile assembly equipment for proposed 1 story, 120 x 1,952 ft. plant on Mt. Elliott Ave.

Mich., Detroit — Liberty Starter Co., 241 Minnie St.—machinery and equipment for light manufacturing for automobile parts factory. Estimated cost $50,000.

Mich., Saginaw—Baker Perkins Co. Inc., Hess Ave.—traveling crane and equipment for brass foundry department for proposed 1 story, 100 x 230 ft. foundry.

N. Y., Rome—Rome Strip Steel Co.—3 ton overhead crane, 20 ft. 4 in. span.

O., Cleveland—Eaton Axle & Spring Co., East 65th St. and Central Ave.—milling and grinding machines.

O., Cleveland—Lyons Machine Co., 5601 Tillman Ave.—32 x 32 ft. open side planer.

O., Cleveland — Modern Pattern Shop, 3409 East 93rd St.—20 in. wood planer.

O., East Liverpool—Patterson Welding & Repair Co., R. L. Cawood—welding equipment including lathe, grinding machine and air compressor for new shop.

Pa., Apollo — Apollo Steel Co. — 15 ton electric crane, 69 ft. span.

Ont., Hamilton—Bd. of Education, City Hall, R. H. Foster, Secy.—complete equipment for proposed 2 story addition to motor mechanics department of technical school. Estimated cost $60,000.

Ont., Orillia—Ditchburn Boats Ltd.—complete equipment for proposed marine railway and repair shops for launches. Estimated cost $30,000.

Opportunities for Future Business

Calif., Los Angeles — Los Angeles City School Dist., is having plans prepared for the construction of a junior high school including shop, etc. Estimated cost $350,000. Private plans.

Conn., Berlin—Goss & Deleeuw Machine Co., awarded contract for a 2 story addition to plant.

Conn., East Hartford — Capital Parlor Frame Co., 470 Tolland St., had plans prepared for the construction of a 1 story, 60 x 200 ft. factory. Estimated cost $45,000. G. Zunner, 182 High St., Hartford, Archt.

Conn., New Haven—Cooley Chevrolet Co. Inc., 158 Whalley Ave., plans the construction of a garage and automobile service station. Estimated cost $100,000. Architect not selected.

Ill., East Peoria—Altorfer Bros., manufacturers of washing machines, plans a 100 x 600 ft. addition to plant. Estimated cost $250,000.

Ind., Connersville — Auburn Automobile Co., C. F. Gard, Supt., awarded contract for a 1 story, 80 x 100 ft. factory. Estimated cost $75,000.

Ia., Des Moines—Wood Bros. Thresher Co., has work under way on two additions to plant. Estimated cost $60,000.

Me., Belfast—City Vulcanizing Co., c/o Edwards Sales Co., 443 Congress St., Portland, Archt., is having plans prepared for the construction of a 2 story, 50 x 85 ft. repair and service garage here.

Mass., Belmont (Boston P. O.) — Cambridge Improvement Corp., 433 Marlboro St., Boston, is having preliminary plans prepared for a 1 story, 135 x 200 ft. garage and repair shop on Wilson Ave. Estimated cost $40,000. E. Nolte, 79 Milk St., Boston, Archt.

Mass., Cambridge (Boston P. O.)—Massachusetts Institute of Technology, Massachusetts Ave., awarded contract for the construction of a 1 story, 65 x 155 ft. engine testing laboratory to Chase & Gilbert, 250 Stuart St., Boston. Noted Sept. 6.

Mass., Chester—Courtland Grinding Wheel Corp., Huntington Rd., awarded contract for a 2 story factory. Estimated cost $40,000.

Mass., Rosindale (Boston P. O.) — G. Mosgavere, 20 Belgrade Ave., will build a 1 story, 50 x 100 ft. repair and service garage on Belgrade Ave. Estimated cost $40,000. Krokyn & Browne, 220 Devonshire St., Boston, Archts.

Mich., Detroit—Chrysler Motor Car Co., 341 Massachusetts Ave., Highland Park, awarded contract for a 4 story, 50 x 120 ft. addition to automobile plant, on East Jefferson Ave., here. Estimated cost $50,000.

Mich., Lansing—Motor Wheel Corp., plans the construction of a 200 x 400 ft. addition to factory. Estimated cost $100,000.

Minn., Crooston—Lappen Foundry, J. E. Lappen, Prop., has work under way on a 1 story, 60 x 120 ft. foundry.

Minn., Faribault — Sellner Mfg. Co. awarded contract for a 2 story, 60 x 80 ft. woodworking plant.

Minn., Minneapolis — W. S. Dwinnell awarded contract for a 1 story, 40 x 160 ft. factory at 24th St. and Hiawatha Ave. Carleton Screw Products Co., 121 27th Ave. S. E., lessee.

Minn., St. Paul—Siems-Stembel Co., 3200 Como Ave. W., will build a 1 story, 142 x 228 ft. car shop at 3136 Como Ave. W. Estimated cost $30,000.

N. J., Newark—R. G. Smith Tool & Mfg. Co., 245 North J. R.R. Ave., is having plans prepared for a 1 story, 100 x 100 ft. factory at 120 Christi St. Estimated cost $40,000. Private plans.

N. J., West New York—Brinkerhoff Electric Co., c/o Lockwood, Greene & Co., 100 East 42nd St., New York, Engrs., is having plans prepared for a 3 story, 70 x 180 ft. factory at 11th St. and Scheley Pl. Estimated cost $75,000.

N. Y., Buffalo—National Grinding Wheel Co., A. Russ, Pres., 2984 Main St., awarded contract for the construction of a factory at Erie Ave. and North Tonawanda St. Estimated cost $70,000.

N. Y., New York—Bd. of Health, S. W. Wynne, Pres., 505 Pearl St., awarded general contract for the construction of a service building at Willard Parker Hospital, Ft. East 16th St. Estimated cost $237,000.

N. Y., New York—Gail Kennedy Realty Corp., 30 Whitewood Ave., New Rochelle, will receive bids after January 1 for the construction of two 1 story, 90 x 100 and 90 x 103 ft. garages at Jerome Ave. and 181st St. here. Estimated cost $200,000. J. P. Boyland, 305 East Kingsbridge Rd., Archt. Noted Sept. 27.

N. Y., New York—J. Land, 525 7th Ave., plans the construction of a 2 story garage at Goble Pl. and Macombs Rd. Estimated cost $150,000. F. J. Ricker, 1328 Broadway, Archt.

N. Y., Tonawanda — Curtis Airplane & Motor Co., 74 Kail St., Buffalo, awarded contract for a 1 and 3 story, 60 x 200 and 200 x 1,500 ft. factory, here. Estimated cost $3,000,000. Noted Sept. 27.

N. D., Minot—Kulver Motor Co., H. A. Kulver, Pres., is receiving bids for a 1 story, 64 x 89 ft. garage. Bugenhagen & Molander, Archts.

O., Alliance — Alliance Aircraft Corp., manufacturers of airplanes and motors, plans the construction of a 1 story, 60 x 300 ft. factory on Union Ave. Estimated cost $40,000.

O., Canton—Timken Roller Bearing Co., Dauber Ave. S. W., plans the construction of a 1 story, 131 x 287 ft. factory, also 1 story addition to shipping plant at 18th St. S. W. Estimated cost $100,000 and $50,000 to $75,000 respectively.

O., Cleveland—The Briggs Mfg. Co., 11631 Mack Ave., Detroit, Mich., manufacturers of automobile bodies, awarded contract for a 5 story, 200 x 350 ft. addition to factory on Taft Ave. Estimated cost $40,000.

O., Cleveland—Buckeye Forging Co., J. W. Baxter, Pres., 10205 Harvard Ave., awarded contract for a 1 story, 60 x 120 ft. machine shop. Estimated cost $40,000. Noted Oct. 11.

O., Cleveland—Cloyes Gear Co., R. T. Cloyes, Pres., 1614 Collamer Ave., awarded contract for a 1 and 2 story, 30 x 140 ft. factory on Arabelle Rd. Estimated cost $40,000.

O., Cleveland—Eaton Axle Co., East 140th St., awarded contract for a 1 story, 330 x 401 ft. factory at 661 East 140th St. Estimaed cost $300,000.

O., Cleveland — Gears & Forgings Inc., 3010 Woodhill Rd., awarded contract for a 3 story, 72 x 72 ft. addition to factory. Estimated cost $50,000. Noted Oct. 4.

O., Cleveland—The Royal Brass Mfg. Co., 1420 East 43rd St., awarded contract for a 1 story, 34 x 132 ft. factory. Estimated cost $40,000.

O., Cleveland — W. A. Wendler, 2120 East 83rd St. (antiques), awarded contract for a 2 story, 37 x 60 ft. factory at 7908 Carnegie Ave. Estimated cost $40,000.

O., Wooster — Mackintosh-Hemphill Co., manufacturers of rolling mill machinery, etc., plans the construction of a 2 story factory. Estimated cost $40,000.

Pa., Philadelphia—R. Greenberg, Morris Bldg., will build a 2 story sales and service station at Sedgley St. Estimated cost $200,000. P. S. Tyre, 114 South 15th St., Archt.

Pa., Pittsburgh — Franklin Mortgage & Investment Co., Franklin Trust Bldg., Philadelphia, awarded contract for a 3 story, 120 x 170 ft. garage at Magee and Locust Sts., here. Estimated cost $250,000. U. S. Government, lessee. Noted Aug. 9.

S. D., Rapid City—Rapid City, Black Hills, Western Ry. Co., awarded contract for the construction of a roundhouse and machine shop.

Tex., Smithville — Missouri-Kansas Texas R.R., St. Louis, Mo., awarded contract for the construction of terminal facilities including roundhouse, 80 x 80 ft. machine shop, etc. here. F. Ringer, Ch. Engr.

Vt., St. Johnsbury—American Fork & Hoe Co. awarded contract for a 1 and 2 story factory, etc., at 8 Ely St.

Wash., Seattle — Ramapago Ajax Corp. plans the construction of a 110 x 200 ft. frog and switch manufacturing plant at First Ave. S. and Hudson St. Estimated cost $400,000. Racor Pacific Frog & Switch Co., lessee.

W. Va., Parkersburg—Parkersburg Rig & Reed Co. awarded contract for a 1 story addition to factory. Estimated cost $75,000.

Ont., Brantford — Dominion Radiator & Boiler Co., Ltd., 1322 Dufferin St., Toronto, plans the construction of a 1 and 2 story addition to plant here. Estimated cost $200,000.

Ont., Oshawa — Mercury Service Ltd. awarded contract for a 3 story, 80 x 150 ft. garage at King and Mary Sts. Estimated cost $80,000.

Ont., Toronto—Link Belt Ltd., 791 Eastern Ave., awarded general contract for the construction of a 1 story machine shop. Estimated cost $100,000.